



# **THEA FOSS AND WHEELER-OSGOOD WATERWAYS REMEDIATION PROJECT**

## **YEAR 9 MONITORING**

### **ANNUAL OPERATIONS, MAINTENANCE, AND MONITORING REPORT**

**OCTOBER 13, 2015**



Prepared for:

**U.S. ENVIRONMENTAL PROTECTION AGENCY**

Prepared by:

**CITY OF TACOMA**

## **1.0 INTRODUCTION**

### **1.1 Purpose and Objectives of Operations, Maintenance, and Monitoring Plan Activities**

This document presents a summary of operations, maintenance, and monitoring activities performed in 2015 for the Thea Foss and Wheeler-Osgood Waterways Remediation Project (Foss Project). Operations, maintenance, and monitoring activities were performed during Year 9 at the habitat areas within the Foss Project site and at the confined disposal facility (Figure 1-1). The work was performed in accordance with the Operations, Maintenance, and Monitoring Plan (OMMP) for the Thea Foss and Wheeler-Osgood Waterways Remediation Project (City of Tacoma 2006). Remediation construction was completed in 2006 by the City of Tacoma (City) under a Consent Decree (CD) issued by the U.S. Environmental Protection Agency (EPA).

The OMMP describes the baseline and long-term qualitative, physical, and chemical monitoring to be completed at the site and sets forth specific performance standards for planned monitoring activities to demonstrate that the long-term objectives for the project are met. The OMMP also details the process for contingency planning and presents possible response actions in the event that performance standards are not achieved.

Figure 1-2 shows the remedial actions completed by the City in the Thea Foss and Wheeler-Osgood Waterways. The area in which the City performed remedial actions as part of the Foss Project is identified as the City's work area. Also identified on Figure 1-2 is the Utilities' work area at the head of the Thea Foss Waterway. In this area, monitoring is being performed by the Utilities in accordance with the Head of the Thea Foss Waterway Remediation Project, Operations, Maintenance and Monitoring Plan (PacifiCorp 2003). The City continues to work cooperatively with the Utilities work group to respond to the identified recontamination occurring in their work area.

The OMMP was prepared in compliance with the Record of Decision (ROD) (EPA 1989), Administrative Order on Consent (AOC) / Statement of Work (SOW) (EPA 1994) for pre-remedial design investigation and remedial design, Explanation of Significant Difference (ESD) (EPA 1997), 2000 ESD, 2004 ESD, and the CD/SOW (EPA 2003) for remediation construction. The work completed in accordance with the OMMP is also in compliance with these documents.

The OMMP establishes an integrated program designed to evaluate and ensure the effectiveness of the remedial actions relative to the project Remedial Action Objectives (RAO). Work being performed under the OMMP is intended to ensure that the completed remedial actions performed at the site achieve the performance objectives as specified in the ROD and subsequent ESDs as related to the protection of surface sediment, surface water, and biological and physical habitat quality.

The RAO for the cleanup is stated in the ROD as:

- The objective of the selected remedy is to achieve acceptable sediment quality in a reasonable timeframe.



Additional language in the ROD states that the remedy was designed to incorporate the following:

- Natural recovery considerations are used to identify sediment remedial action levels that delineate sediments that are allowed to recover naturally from those that require active sediment cleanup;
- The sediment quality objective also applies to source control requirements. Monitoring sources and sediments will be used to determine the effectiveness of source controls; and
- Habitat function and enhancement of fisheries resources will also be incorporated as part of the overall project cleanup objectives.

The OMMP was developed and results will be evaluated to ensure that the RAOs for the site are achieved.

## **1.2 Scope of the Year 9 Operations, Maintenance, and Monitoring Report**

The monitoring tasks and information comprising Year 9 and included in this report are the following:

- Habitat mitigation area monitoring including qualitative monitoring of the cap and berm at the St. Paul Waterway Confined Disposal Facility (CDF); and
- Status of additional project related tasks that include the following:
  - Implementation of tasks required under the Institutional Controls Plan (ICP);
  - Ongoing stormwater source control activities;
  - Ongoing work to deauthorize the navigational channel in encroachment areas.

Table 1-1 summarizes the overall monitoring schedule for OMMP activities to be performed.

## **1.3 Organization of the Annual OMMP Reports**

For each monitoring year, an Annual Operations, Maintenance, and Monitoring Report (Annual Report) is prepared presenting the final, comprehensive information and data for monitoring activities completed in the previous year. The Annual Report will also document any decisions and/or contingency actions, planned or implemented.

The structure of the Annual Report for Year 9 Monitoring, and all Annual Reports, follows the outline of the OMMP to provide a consistent presentation and placement of information generated to monitor remedial actions performed as part of the Foss Project.

The following topics are presented in the Annual Report:

- Section 1.0 – Introduction
- Section 2.0 – Sediment Remediation Area Performance Monitoring
- Section 3.0 – Early Warning Monitoring for Recontamination
- Section 4.0 – Benthic Recolonization Monitoring

- Section 5.0 – Confined Disposal Facility Monitoring
- Section 6.0 – Habitat Mitigation Area Monitoring
- Section 7.0 – Additional Project Related Activities

The Annual Report also includes the following appendices:

- Appendix A – Physical Cap Integrity Monitoring
- Appendix B – Sediment and Cap Performance Monitoring
- Appendix C – Benthic Recolonization Monitoring
- Appendix D – Confined Disposal Facility Monitoring
- Appendix E – Habitat Mitigation Area Monitoring
- Appendix F – Health and Safety Plan
- Appendix G – Additional Project Related Activities

During monitoring years when any of these tasks are not required, placeholders will be maintained in the report so that information for a specific activity will consistently be in a specific section. For example, Habitat Mitigation Area Monitoring will consistently be found in Section 6.0 and Appendix E of the Annual Reports.

**TABLES**

1-1 – Monitoring Schedule

**FIGURES**

1-1 – Project Location Map

1-2 – Completed Remedial Actions

**Table 1-1  
Monitoring Schedule**

Activity	Monitoring Year (Calendar Year)										
	Year 0 (2006)	Year 1 (2007)	Year 2 (2008)	Year 3 (2009)	Year 4 (2010)	Year 5 (2011)	Year 6 (2012)	Year 7 (2013)	Year 8 (2014)	Year 9 (2015)	Year 10 (2016)
<b>1) Sediment Remediation Area Performance Monitoring</b>											
Supplemental Data Collection for Natural Recovery Area Sediment Quality	X										
Sediment Quality (0 to 10 cm) Performance Monitoring of Cap and Natural Recovery Areas			X		X			X			X
Low Tide Slope Cap Inspection for Cap Integrity	X		X		X			X			X
Subtidal Cap Hydrographic Survey for Cap Integrity			X		X			X			X
<b>2) Early Warning Monitoring for Recontamination</b>											
Sediment Quality (0 to 2 cm) Monitoring			X		X			X			X
<b>3) Benthic Recolonization Monitoring</b>											
Sediment Profile Imaging and Archive Sediment Sample (0 to 10 cm) Collection			X		X			X			X
<b>4) Confined Disposal Facility Monitoring</b>											
72-Hour Tidal Study and Slug Tests	X										
Baseline Monitoring		4Q	4Q								
Performance Monitoring					X			X			X
<b>5) Habitat Mitigation Area Monitoring</b>											
Qualitative Ground Surveys <sup>1</sup>	X	X	X	X	X	X	X	X	X	X	X
Quantitative Vegetation Surveys		X	X		X			X			X



Activity	Monitoring Year (Calendar Year)										
	Year 0 (2006)	Year 1 (2007)	Year 2 (2008)	Year 3 (2009)	Year 4 (2010)	Year 5 (2011)	Year 6 (2012)	Year 7 (2013)	Year 8 (2014)	Year 9 (2015)	Year 10 (2016)
Photo Documentation	X	X	X		X			X			X
Elevation Monitoring <sup>2,3</sup>	X	X	X	X		X		X			X
Brackish Marsh Salinity Monitoring	X	X									
Juvenile Salmonid Monitoring		X		X							
Invertebrate Monitoring		X		X							
Water Surface Elevation Monitoring	X			X		X		X			X

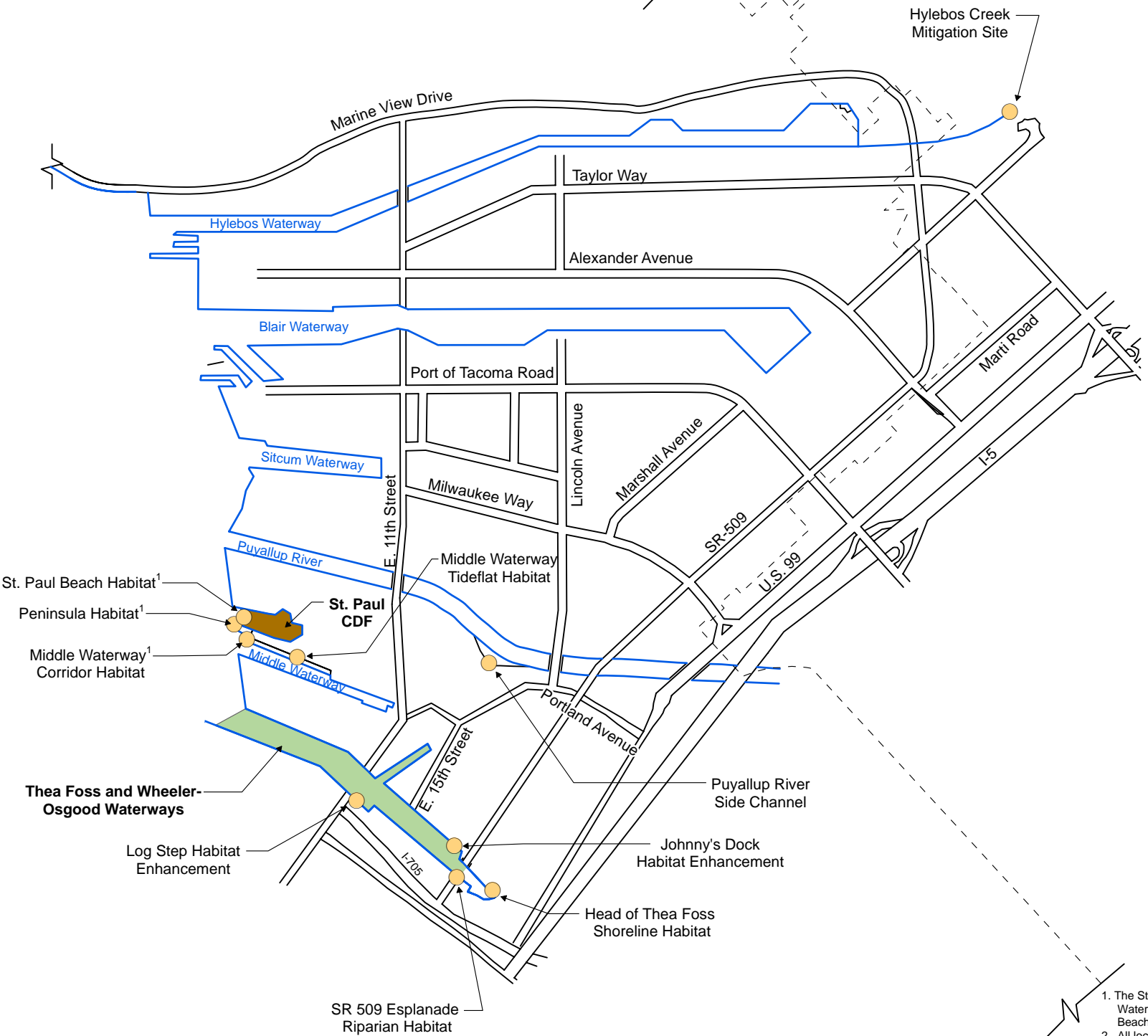
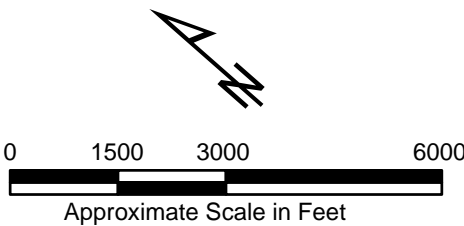
## Notes:

4 Q Four quarters.

- 1 Includes visual observations of the containment berm and offset berm and the CDF cap. In addition, photographs will be taken at North Beach photo points P-1 through P-5 at each qualitative monitoring event to track the erosion which has occurred at the site.
- 2 The vertical datum used during the construction phase of the project was MLLW. Due to the length of the OMMP monitoring period and the fact that MLLW changes over time, the vertical datum to be used during this phase has been designated as NGVD 29.
- 3 Note that survey transects of the channels at Hylebos Creek will be performed annually while monitoring of elevation stakes at other locations will be performed on the schedule shown.

**Legend**

- Enhancement, Mitigation, and Habitat Areas
- Thea Foss and Wheeler-Osgood Waterways
- St. Paul CDF



**NOTES**

1. The St. Paul Beach Habitat, Peninsula Habitat, and the Middle Waterway Corridor Habitat are collectively called the North Beach Habitat.
2. All locations are approximate.



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Annual OMMP Report**

**Figure 1-1  
Project Location Map**

**Legend**

- 8

 Remedial Areas
- Completed Remedial Actions:**

No Action

Slope Rehabilitation

Natural Recovery

Enhanced Natural Recovery

Habitat Enhancement

Backfill

Channel Sand Cap

Slope Cap

Dredge to Clean

Grout Mat Cap

Transition Slope

Quarry Spalls

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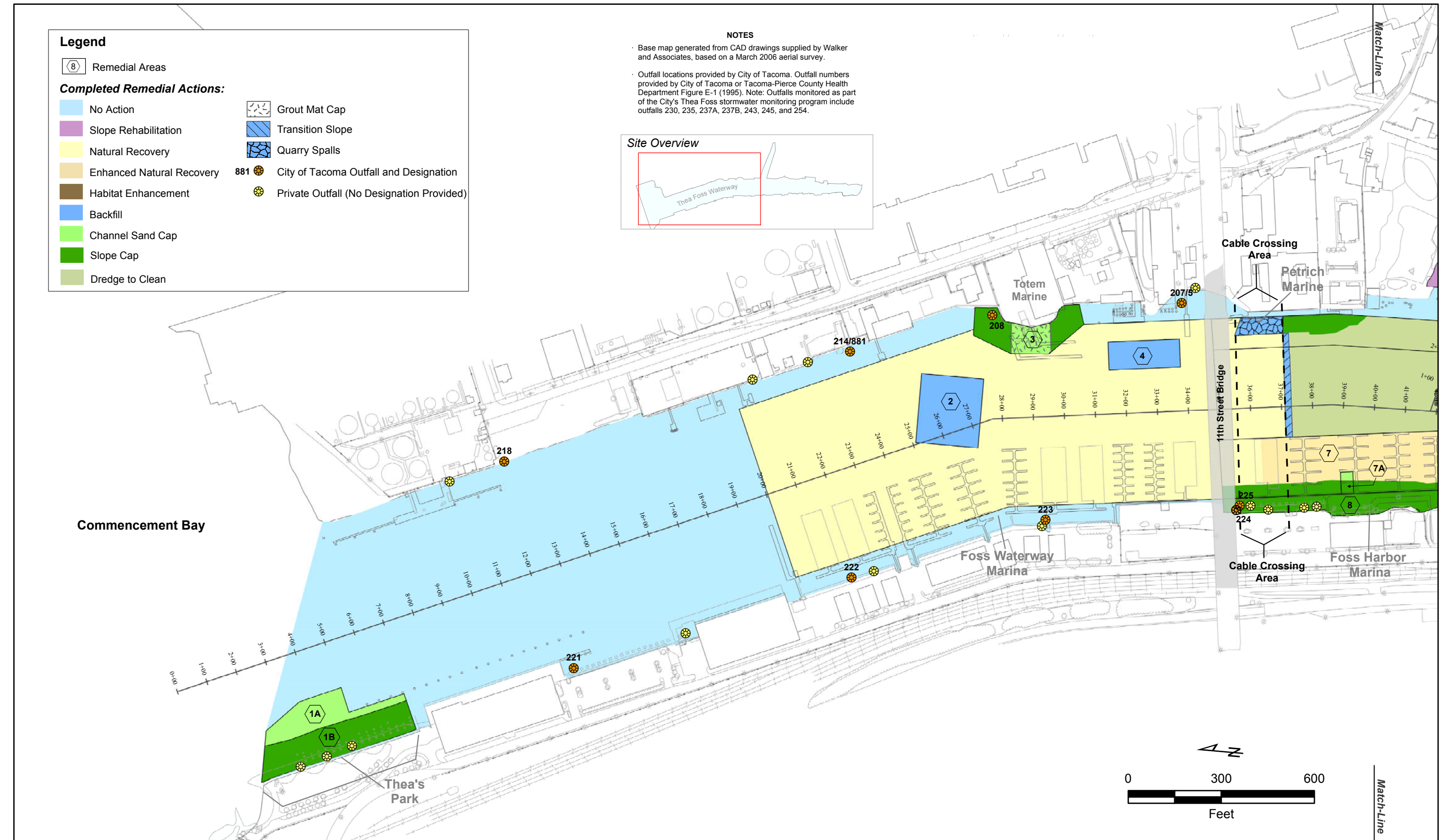
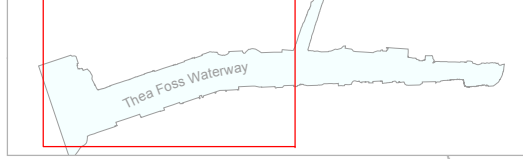
 City of Tacoma Outfall and Designation

Private Outfall (No Designation Provided)

**NOTES**

- Base map generated from CAD drawings supplied by Walker and Associates, based on a March 2006 aerial survey.
- Outfall locations provided by City of Tacoma. Outfall numbers provided by City of Tacoma or Tacoma-Pierce County Health Department Figure E-1 (1995). Note: Outfalls monitored as part of the City's Thea Foss stormwater monitoring program include outfalls 230, 235, 237A, 237B, 243, 245, and 254.

**Site Overview**



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**Figure 1-2 (Page 1 of 2)  
Completed Remedial Actions**





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Figure 1-2 (Page 2 of 2)  
Completed Remedial Actions



**Table 1-1  
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Performance Monitoring					X			X			X
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Qualitative Ground Surveys <sup>1</sup>	X	X	X	X	X	X	X	X	X	X	X
Quantitative Vegetation Surveys		X	X		X			X			X

Activity	Monitoring Year (Calendar Year)										
	Year 0 (2006)	Year 1 (2007)	Year 2 (2008)	Year 3 (2009)	Year 4 (2010)	Year 5 (2011)	Year 6 (2012)	Year 7 (2013)	Year 8 (2014)	Year 9 (2015)	Year 10 (2016)
Photo Documentation	X	X	X		X			X			X
Elevation Monitoring <sup>2,3</sup>	X	X	X	X		X		X			X
Brackish Marsh Salinity Monitoring	X	X									
Juvenile Salmonid Monitoring		X		X							
Invertebrate Monitoring		X		X							
Water Surface Elevation Monitoring	X			X		X		X			X

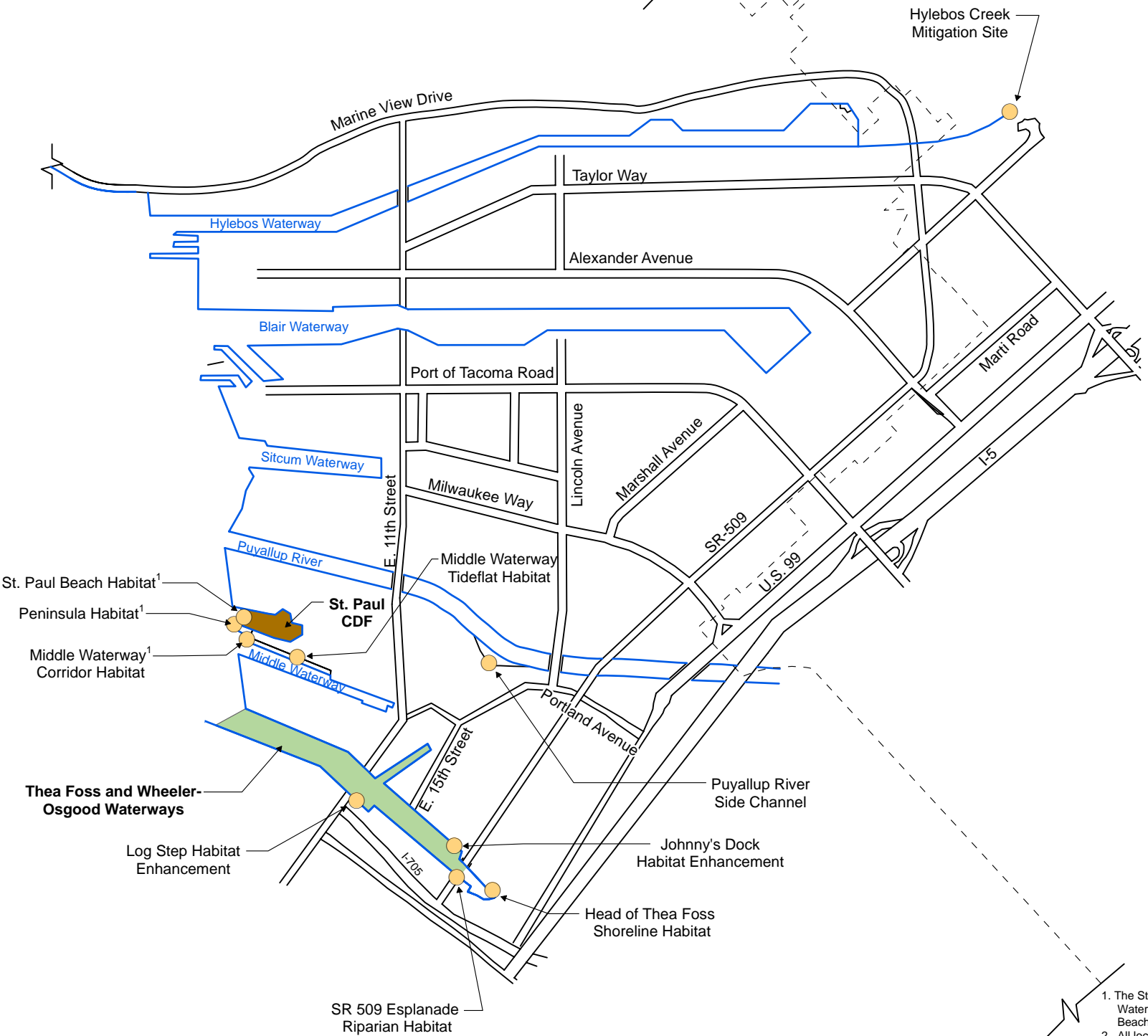
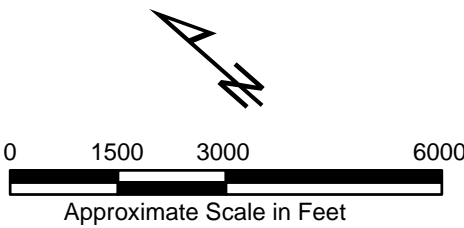
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- 2 The vertical datum used during the construction phase of the project was MLLW. Due to the length of the OMMP monitoring period and the fact that MLLW changes over time, the vertical datum to be used during this phase has been designated as NGVD 29.
- 3 Note that survey transects of the channels at Hylebos Creek will be performed annually while monitoring of elevation stakes at other locations will be performed on the schedule shown.

**Legend**

- Enhancement, Mitigation, and Habitat Areas
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Annual OMMP Report**

**Figure 1-1  
Project Location Map**

**Legend**

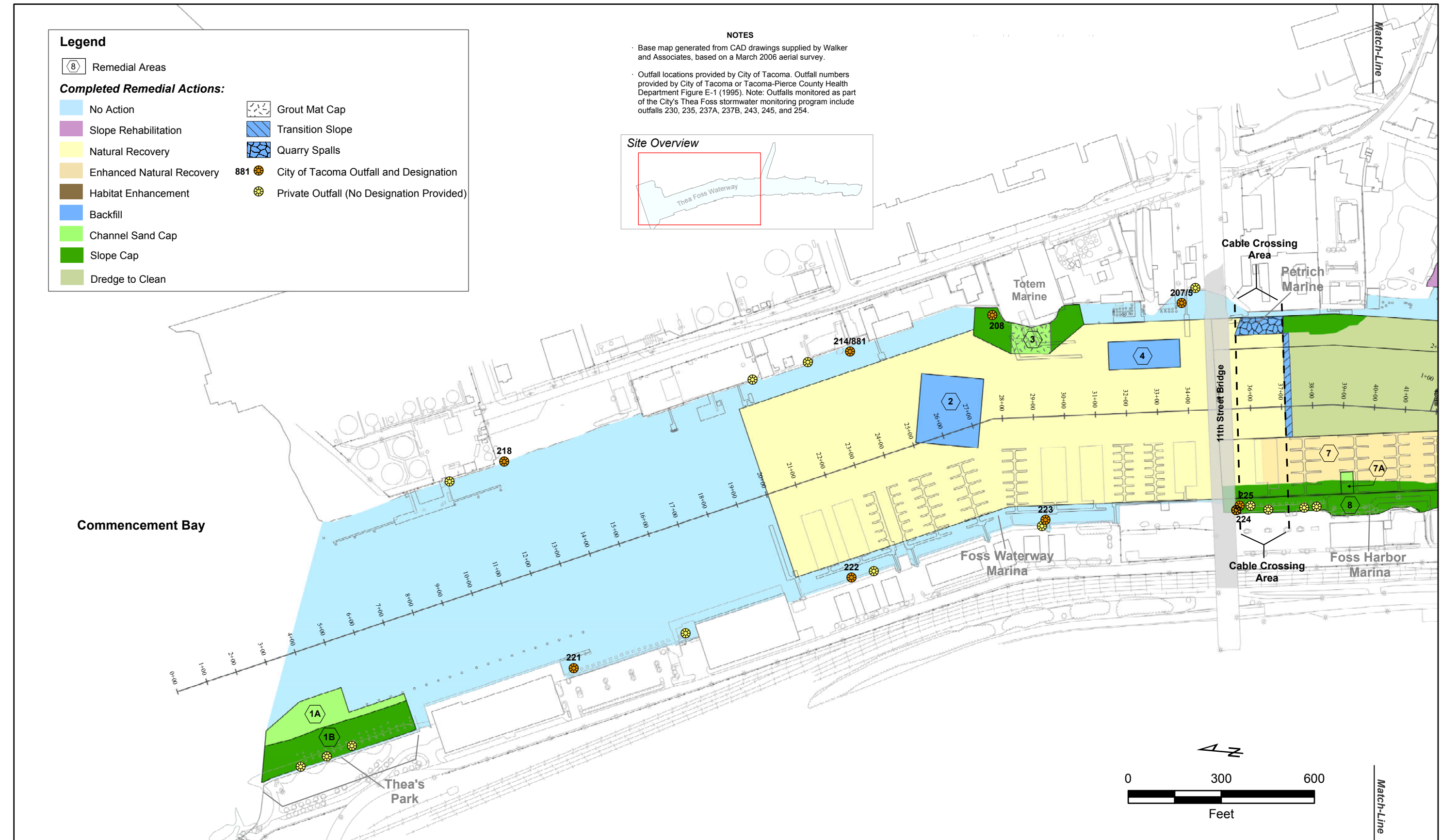
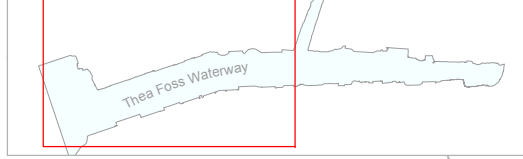
- 8

 Remedial Areas
- Completed Remedial Actions:**
- |                           |  |
|---------------------------|--|
| No Action                 | Grout Mat Cap                              |
| Slope Rehabilitation      | Transition Slope                           |
| Natural Recovery          | Quarry Spalls                              |
| Enhanced Natural Recovery | City of Tacoma Outfall and Designation 881 |
| Habitat Enhancement       | Private Outfall (No Designation Provided)  |
| Backfill                  |  |
| Channel Sand Cap          |  |
| Slope Cap                 |  |
| Dredge to Clean           |  |

**NOTES**

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**Site Overview**



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**Figure 1-2 (Page 1 of 2)  
Completed Remedial Actions**





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Annual OMMP Report**

**Figure 1-2 (Page 2 of 2)  
Completed Remedial Actions**

### 2.0 SEDIMENT REMEDIATION AREA PERFORMANCE MONITORING

Sediment remediation area performance monitoring is performed to evaluate the long-term effectiveness of sediment caps, enhanced natural recovery, and natural recovery remedies implemented by the City of Tacoma as part of the Thea Foss and Wheeler-Osgood Waterways Remediation Project. Performance monitoring activities include physical inspection of capped areas to ensure that the engineered caps remain intact; chemical monitoring of the cap surface (0 to 10 cm) sediments to confirm that the underlying contaminants are contained; and chemical monitoring of surface (0 to 10 cm) sediments within natural recovery and enhanced natural recovery areas to confirm that natural recovery is occurring within the compliance period. The monitoring program includes the collection, analysis, and interpretation of sediment physical and chemical quality data from intertidal sampling locations, channel cap sampling locations, and at natural recovery sampling locations, and conducting hydrographic surveys and low tide slope cap inspections.

As described in Section 2.0 of the Operations, Maintenance, and Monitoring Plan (OMMP) (City of Tacoma 2006), sediment remediation area performance monitoring is performed to achieve the following objectives:

- Ensure sediment caps provide effective containment, both physically and chemically, of contaminated underlying sediments, and provide a substrate that promotes colonization by aquatic organisms; and
- Confirm that within natural recovery areas chemical concentrations will attenuate to below Sediment Quality Objectives (SQOs) within the 0 to 10 cm compliance interval within 10 years of completion of remediation construction (i.e., by 2016).

Sediment remediation area performance monitoring was not required as part of Year 9 OMMP activities. Sediment remediation area performance monitoring was performed during baseline and Year 2, Year 4 and Year 7 monitoring, and will be performed again in Year 10. The schedule for OMMP activities to be performed as part of the Thea Foss and Wheeler-Osgood Waterways Remediation Project (Foss Project) is presented in Table 1-1. The detailed scope of sediment remediation area performance monitoring activities to be conducted in Year 10 is described in the OMMP.

### **3.0 EARLY WARNING MONITORING FOR RECONTAMINATION**

Early warning monitoring for recontamination, referred to as early warning monitoring, will be performed to evaluate the potential for recontamination in the Thea Foss and Wheeler-Osgood Waterways. As described in Section 3.0 of the Operations, Maintenance, and Monitoring Plan (OMMP) (City of Tacoma 2006), early warning monitoring includes collection and analysis of recently deposited sediments represented by the 0 to 2 cm interval of the sediment column. Early warning sampling and analysis data will be used to evaluate the potential for recontamination and identify potential sources of recontamination (if suspected) before the remediated sediments become out of compliance with the remedial action and long-term monitoring objectives. Early warning monitoring will be performed throughout the Thea Foss and Wheeler-Osgood Waterways including dredged to clean, capped, and natural recovery areas.

Early warning monitoring is specifically designed to achieve the following objectives:

- Monitor the chemical quality of recently deposited sediments in remediation areas of the Thea Foss and Wheeler-Osgood Waterways with attention to potential sources of recontamination (i.e., marinas, outfalls, industrial facilities, etc.); and
- Identify potential sources of recontamination if exceedances of chemical Sediment Quality Objectives (SQO) and early warning threshold concentrations have occurred or are predicted to occur.

Early warning monitoring was not required as part of Year 9 OMMP activities. Early warning monitoring was performed as part of Year 4 and Year 7 monitoring activities and will be performed next in Year 10. The schedule for OMMP activities to be performed as part of the Thea Foss and Wheeler-Osgood Waterways Remediation Project (Foss Project) is presented in Table 1-1. The scope of early warning monitoring to be conducted in Year 10 is described in the OMMP.

## **4.0 BENTHIC RECOLONIZATION MONITORING**

Periodic monitoring is being performed in the Thea Foss and Wheeler-Osgood Waterways to track the progress of benthic recolonization. Benthic habitat was altered by historical contamination and sediment dredging and capping actions completed in the waterways. Given the habitat improvements resulting from the completed remedial actions, the waterway is expected to be recolonized by benthic infauna and epifauna common to Commencement Bay. As described in Section 4.0 of the Operations, Maintenance, and Monitoring Plan (OMMP) (City of Tacoma 2006), benthic recolonization monitoring utilizes Sediment Profile Imaging (SPI) technology. SPI will allow for data to be collected on sediment composition, benthic habitat classification, infaunal successional stages, redox potential discontinuity, and organism-sediment index. Data from each specific location within a remediation area will be evaluated relative to previous years of monitoring at the specific location to assess the rate and success of benthic recolonization.

The objective of the benthic recolonization monitoring is to document and evaluate the success of benthic recolonization in the Thea Foss and Wheeler-Osgood Waterways. Benthic recolonization will be evaluated throughout the waterways including dredged to clean, capped, and natural recovery areas as described in the OMMP. Additionally, four benthic monitoring locations outside of the remediated areas near the mouth of the waterway are included to provide background information in non-remediated areas.

Benthic recolonization monitoring was not required as part of Year 9 OMMP activities. Benthic recolonization monitoring was performed in Year 4 and Year 7 monitoring activities and will be performed next in Year 10. The schedule for OMMP activities to be performed as part of the Thea Foss and Wheeler-Osgood Waterways Remediation Project (Foss Project) is presented in Table 1-1. The scope of benthic recolonization monitoring to be conducted in Year 10 is described in the OMMP.



## **5.0 CONFINED DISPOSAL FACILITY PERFORMANCE MONITORING**

As described in the St. Paul Waterway Confined Disposal Facility Performance Monitoring Plan dated February 18, 2010, the objective of CDF performance monitoring is to compare long-term post-construction groundwater quality with baseline conditions established in the first two years following construction, to determine if constituents are being transported in groundwater from the CDF at concentrations that could pose a potential threat to surface water quality at the point of compliance. This comparison allows for the evaluation of the effectiveness of the remedy to ensure that the selected remedy remains protective, and an assurance that baseline concentrations are not exceeded in the surface water outside of the CDF. The performance standard for the performance monitoring program is to evaluate whether statistically significant increases in contaminant concentrations relative to the established groundwater baseline concentrations are observed.

Performance monitoring at the CDF is specifically designed to achieve the following objectives:

- Monitoring at the disposal site to evaluate the effectiveness of the remedy; and
- The St. Paul disposal site will be subject to long-term monitoring to ensure that the selected remedy remains protective, including that baseline concentrations are not exceeded in surface water outside of the CDF after construction.

CDF performance monitoring was not required as part of Year 9 OMMP activities. CDF performance monitoring was performed as part of Year 4 and Year 7 monitoring activities and will be performed next in Year 10. The scope and schedule for CDF performance monitoring activities to be performed as part of the Thea Foss and Wheeler-Osgood Waterways Remediation Project (Foss Project) are described in the St. Paul Waterway Confined Disposal Facility Performance Monitoring Plan.

## **6.0 HABITAT MITIGATION AREA MONITORING**

### **6.1 Introduction**

This section presents a summary of the Year 9 habitat mitigation area monitoring performed at the Thea Foss and Wheeler-Osgood Waterways Remediation Project (Foss Project) habitat mitigation and enhancement area sites. This habitat mitigation area monitoring was performed in accordance with the Operations, Maintenance, and Monitoring Plan (OMMP) for the Thea Foss and Wheeler-Osgood Waterways Remediation Project (City of Tacoma 2006) as modified by the Annual Technical Memoranda submitted for agency review. Activities performed during Year 9 monitoring are identified in Table 6-1.

As described in Section 6.0 of the OMMP, the habitat mitigation areas for the project are identified as the North Beach Habitat, Middle Waterway Tideflat Habitat, Puyallup River Side Channel, and the Hylebos Creek Mitigation Site. Constructed acreages of these mitigation areas are provided in Table 6-2. The Thea Foss Habitat Enhancement Areas are identified as the Johnny's Dock Habitat Enhancement, Head of Thea Foss Shoreline Habitat, SR 509 Esplanade Riparian Habitat, and the Log Step Habitat Enhancement.

The following sections summarize the habitat mitigation area monitoring requirements, monitoring activities performed during Year 9, the findings of these inspections, and whether the performance objectives for each activity have been achieved.

#### **6.1.1 Habitat Mitigation Area Monitoring Objectives**

The OMMP specifies that habitat mitigation monitoring be performed to achieve the following objectives:

- To evaluate the effectiveness of the development of biological features and physical features at the mitigation and enhancement sites to confirm that they are on a trajectory to provide habitat function necessary to meet the objectives for each site; and
- To confirm that the habitat sites have attained and continue to meet the objectives for each site over time.

The OMMP requires that various components of habitat mitigation monitoring occur throughout the first ten years following completion of the remedial action. After 10 years of monitoring, the City of Tacoma (City) and U.S. Environmental Protection Agency (EPA) will evaluate the need for and scope of additional monitoring.

#### **6.1.2 Scope of Habitat Mitigation Area Monitoring**

Habitat mitigation area performance monitoring consists of three components: habitat mitigation area monitoring, habitat mitigation area maintenance, and contingency planning and response actions, as needed.

The following monitoring activities are performed during the various monitoring periods:

- Qualitative monitoring, including observations of evidence of erosion or sedimentation, evidence of damage or disease, condition of large woody debris (LWD) and goose

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## Section 6.0 – Habitat Mitigation Area Monitoring

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enclosures, conditions/types of vegetation, species of wildlife observed, and soil/sediment quality. In addition, it includes a qualitative evaluation of the CDF cap and berms;

- Quantitative monitoring, including estimates of cover of various vegetation types, density of plants in marsh areas, and notes on types of vegetation present (not required in Year 9);
- Photo documentation, consisting of taking photographs at established photo points for comparison with the previous year's photos (not required in Year 9);
- Elevation monitoring by measuring the change in elevation of the sediment surface at the established elevation monitoring locations relative to the baseline elevation, or by measuring the elevation along centerline transects in the channels at Hylebos Creek (only Hylebos Creek transects required in Year 9);
- Brackish marsh salinity monitoring, consisting of the measurement of soil salinity in the irrigated area at the Middle Waterway Tideflat Habitat (requirement completed in Year 1);
- Juvenile salmonid monitoring, consisting of field observations of presence of salmonids at the various mitigation sites (requirement completed in Year 3);
- Invertebrate monitoring, including placement of insect fallout traps in the upper intertidal areas at the Puyallup River Side Channel and the Hylebos Creek Mitigation Site (requirement completed in Year 3); and
- Water surface elevation monitoring at Hylebos Creek for informational purposes (not required in Year 9).

Routine maintenance, performed on an ongoing basis throughout the year, is the key component of the habitat maintenance and monitoring program. The City maintains a contract with the Washington Conservation Corps (WCC) to provide a crew for performance of these routine maintenance activities at the various mitigation and enhancement sites. The crew picks up garbage, waters and mulches plants, tightens LWD cables, pulls, cuts or applies herbicides to weeds, and replants on an as needed basis. A summary of their work during the past year is provided in Section 6.3.

Adaptive management and contingency planning procedures were established in Sections 6.4 and 6.5 of the OMMP. As issues are identified, these procedures are implemented to determine the best course of action. At this time there are no issues that have been identified for follow-up in accordance with these procedures.

### 6.2 Habitat Mitigation Area Monitoring

As required by the OMMP, habitat monitoring activities are generally performed when tidal elevations are below 0.0 feet Mean Lower Low Water (MLLW) except at the Hylebos Creek Mitigation Site where the primary monitoring activities are performed when tidal elevations are below 8.78 feet MLLW. Exceptions to this are noted in the reporting sections as applicable.

Standardized field forms are used to document observations of conditions at the sites.

### **6.2.1 Summary of Habitat Mitigation Area Monitoring**

Year 9 habitat mitigation area monitoring activities are set forth in the OMMP. As indicated above, the primary function of habitat monitoring is to evaluate the effectiveness of the development of biological features and physical features at the mitigation and enhancement sites to confirm that they are on a trajectory to provide habitat function necessary to meet the objectives for each site, and to confirm that the individual habitat sites have attained and continue to meet their objectives over time.

Year 9 habitat monitoring included the following activities:

- Qualitative ground surveys; and
- Elevation monitoring – transects at the Hylebos Creek site only.

Details of these activities at each of the mitigation and enhancement sites are provided below.

### **6.2.2 Summary of Field Activities**

Year 9 habitat monitoring activities were initiated on July 14, 2015, and continued intermittently at the various sites until September 11, 2015. Copies of the completed inspection forms, and survey information for Hylebos Creek are included in Attachment E-1 and Attachment E-3 in Appendix E, respectively. The following is a summary of activities performed at each site.

**North Beach Habitat** – The St. Paul Beach Habitat, Peninsula Habitat, and Middle Waterway Corridor Habitat areas as defined during the construction process are collectively referred to as the North Beach Habitat (see Figure 6-1). These habitat areas are buffered from upland activities by a 10- to 20-foot wide riparian buffer.

The completed St. Paul Beach portion of the habitat area is composed of low gradient, fine grained beach habitat. The beach slopes at a low angle (10H:1V or flatter) to approximately 8 feet MLLW and is composed of habitat mix. The beach then slopes more steeply upward (approximately 3H:1V), meeting the St. Paul Confined Disposal Facility (CDF) berm at an elevation of approximately 13.5 feet MLLW. The beach surface in this area is comprised of habitat mix and rounded cobbles similar to the nearby Olympic View Resource Area beach.

The containment berm face and the adjacent area are planted with native plants to form a riparian buffer. An additional planting area was constructed in 2010 as authorized by EPA to resolve additional habitat acreage owed by the City as a result of the remediation construction project. The area is approximately 15 feet wide and was constructed landward of the edge of the existing riparian zone at the site. Approximately one foot of topsoil was placed across the area prior to planting with riparian vegetation.

The peninsula portion of the habitat area is composed of restored littoral habitat including a continuation of the shallow water habitat contours of the St. Paul Beach. Over 1,900 creosote treated piles were removed from this area during construction so that the existing contours could be covered with sand ranging in depth from six inches to several feet. This portion of the habitat area includes the development of an undulating band of marsh habitat at an elevation of 10 feet MLLW to 12 feet MLLW, above the steeper transition between 8 feet MLLW and 10 feet MLLW. The upper beach slopes to a relatively low pass across the central area of the

peninsula. This pass allows juvenile salmonids moving across the face of the St. Paul Beach at tides above MLLW to continue their migration in relatively protected shallow water into the entrance of the Middle Waterway. North of the pass, the habitat area rises to an offshore shoal or reef at 12 feet MLLW. This shoal partially shelters areas to the south and east from waves from the northwest.

Existing uplands at the tip of the Middle/St. Paul Peninsula were cut back and excavated to provide new marine habitat area at the southwest corner of the site. Eight nodes of marsh species appropriate for lower and upper saltmarsh elevations were planted in this habitat area. Three of these nodes were designated as pilot nodes during the design approval phase of the project due to their exposure and the likelihood that plantings would be difficult to establish. LWD was placed in the southwest corner to increase habitat complexity and to provide protective cover for juvenile salmonids. As a result of some erosion that was identified at the face of the containment berm after the baseline monitoring event, additional LWD was placed at the northwest corner of the site in August 2007.

To accelerate colonization, the design documents required that four additional planting nodes be established at this site in the first or second spring following construction. Due to the continuing shifting of the beach and the minimal organics on the beach in front of the containment berm, the City requested that the location of these additional planting nodes be reconsidered. Following a site visit in late summer 2008, the agencies agreed that two of these nodes would be constructed around the corner of the peninsula, closer to the potential marsh area. These nodes were constructed and planted with a combination of saltgrass, tufted hairgrass, and pickleweed in fall 2009. The other two nodes were placed at the Puyallup River Side Channel as discussed further below. These added nodes are not subject to the performance standards for the site and are therefore not required to be monitored under the OMMP.

The Middle Waterway Corridor portion of the habitat area consists of a narrow shoreline that connects the peninsula portion of the site with the broad mudflats and brackish marsh in the southern portion of Middle Waterway. Approximately 250 feet of stacked concrete bulkhead along the east shore of the Middle Waterway were removed and the slope protected with a thick slope cap and habitat mix. This design provides shallow-water, fish-passable shoreline access to and from the inner Middle Waterway habitat areas during most tidal conditions.

Performance standards for this site include minimal change in elevation; development of saltmarsh and riparian vegetation coverage; and juvenile salmonid presence. Performance standards are intended to ensure that created aquatic and riparian habitat are maintained over time, and to verify that habitat is not lost in the future. As indicated above, for this habitat area, saltmarsh performance standards apply to only five of the ten nodes; three of the original nodes in the most exposed areas of the site and the two added nodes were planted on a pilot basis or to accelerate colonization and do not have performance standards associated with them.

Qualitative Ground Survey – The qualitative ground survey at this site was conducted on July 15, 2015. A copy of the completed field form can be found in Attachment E-1. Overall, the site was noted to be in good and relatively stable condition, although it was quite dry due to the lack of rainfall. Upon arrival, there were small avian species, a great blue heron, a dead seal, seagulls, crows, crabs, swallows, killdeer and a seal observed at the site. No significant amount of erosion was identified, with the exception of the continuation of erosion at the toe of the slope of the containment berm where it meets the habitat beach, which is discussed further below.

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Dynamic beach conditions led to sediment accumulation in some areas and a push of gravel on the outer portion of the cutback area. There was a slight increase in the gravels in the location of the push area compared to that noted in previous monitoring events. The gravel bar continues to grow and stretch southward towards the head of the Middle Waterway parallel to the shoreline creating a low spot of back marsh habitat with some finer sediment present. It is anticipated that this area may trap seed material and plants will continue to establish over time.

There were no indications of animal damage or vandalism found, and very minimal amounts of trash and wrack (bark) associated with the tideline. There were some tire tracks in the riparian area where vehicles had apparently turned around, and these were discussed with the property owner. There was no indication of vegetative disease observed with the exception of some minor indication of willow borer presence. There has been some movement of the LWD in the potential marsh area and they need to have their anchors tightened in place again or in some cases the anchors need to be replaced. There was additional recruitment of logs in the area as well.

As described in the Baseline Annual Report (March 2007), after completion of the baseline qualitative survey in July 2006, some erosion along the toe of slope at the containment berm was identified. Several meetings and discussions with the agencies occurred, and as a result, the City placed additional LWD at agreed upon locations in August 2007. In addition, quarterly photographs and observations of the area were conducted through 2008 in conjunction with the quarterly baseline CDF monitoring. Based upon these quarterly inspections, the erosion appeared to have generally stabilized, and per agency concurrence, the area is now being monitored as part of the regularly scheduled qualitative monitoring of the North Beach Habitat area. During Year 9 monitoring it was noted that the erosion along the face of the CDF berm is generally stabilized, and the rate of erosion appears to be lessening, although there was some additional erosion at the eastern end of the berm below the conveyor belt at the paper mill.

There was no change noted in the appearance of the surface soils in the riparian or aquatic areas relative to previous monitoring events. There was no indication of odor or sheen in either area. Overall, there was no apparent site disturbance identified based on soil conditions and no deficiencies in soil conditions were identified. The CDF cap appears to be in good condition with no evidence of disturbance or deficiency.

Habitat mix/fine-grained material was present at the surface of the upper intertidal area in depths similar to previous observations. Through probing of this material, it was found that the depth of fine-grained material ranged from approximately three inches at the east end of the beach to more than twelve inches present near the peninsula at the northwest corner of the site. The beach substrate is continuing to shift and grade to some extent although it appears fairly stable at this time.

The site was planted in accordance with the approved planting plans. A combination of pickleweed and saltgrass was planted in eight marsh planting nodes. As indicated above, of these, three were considered pilot nodes due to their exposure and were not successful in becoming established. There continues to be minimal success of the saltgrass in the remainder of this area. The pickleweed is spreading in the potential marsh area, although the amount and location fluctuates fairly dramatically each season. Some volunteer fleshy jaumea was also noted in the salt marsh area.

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At the top of the beach, the dunegrass is well established adjacent to the marsh area. Dunegrass is also establishing and continuing to spread along the base of the containment berm where chunks of soil with established roots dropped on the upper intertidal area and where supplemental dune grass plantings were done in 2013 and 2014. The dune grass throughout this area is doing well and is nicely spaced in areas along the front of the berm. This is continuing to help with stabilization of the toe of the slope.

As indicated previously, there is no volunteer vegetation on the shoal/island. It is apparent that the conditions are not favorable for plant establishment in this area.

The original riparian area was hydroseeded and is planted with a combination of American dunegrass, Hooker's willow, and oceanspray. Overall, there was a high survival rate for the riparian plantings in the area above the potential marsh, and a lower survival rate along the CDF berm. In addition, this area is impacted by the erosion of the face of the containment berm discussed above.

The newer riparian area was planted with a combination of Douglas fir, big-leaf maple, Pacific madrone, oceanspray, red-flowering currant, evergreen huckleberry, beaked hazelnut, black hawthorn and snowberry. The trees were planted close to the waterward edge of the new planting area to prevent the root structure from impacting the containment aspect of the berm. A few volunteer species were present in this area at the time of the inspection, with no new species compared to those noted in previous inspections. Significant drought stress was noted.

A few invasive weeds were present in the overall riparian area, including St. John's Wort, Himalayan blackberry, poison hemlock and plantain. Minor weeding of the riparian area is therefore needed.

Quantitative Vegetation Monitoring – Quantitative vegetation monitoring was not required during Year 9.

Photo Documentation – Photo documentation was not required during Year 9. Some general photos of the site were taken during the inspection and are available for review upon request.

Elevation Monitoring – Elevation monitoring was not required during Year 9.

Juvenile Salmonid Monitoring – Juvenile salmonid monitoring as described in the OMMP is complete.

Brackish marsh salinity monitoring, invertebrate monitoring and water surface elevation monitoring are not required at this mitigation site.

Containment Berm Erosion Monitoring – As indicated in previous annual reports, an area of erosion on the bayward face of the containment berm was identified in 2006. The area was monitored closely for several years, and since it appeared to have stabilized, EPA agreed during the Year 3 annual meeting that a response action was not warranted and that the City would continue to monitor the area on a routine basis. In accordance with the CDF Performance Monitoring Plan, the City will perform this monitoring in conjunction with the CDF monitoring which is scheduled to be completed next in Year 10 (2016). The City also agreed to qualitatively monitor the area each year as part of the North Beach Habitat site qualitative monitoring and to note any substantial changes observed in this area. This qualitative

monitoring was performed, and no substantial changes in the conditions were noted. Some continued erosion was observed, along with additional plant establishment on the upper beach. The City performed some supplemental planting of dune grass along the face of the berm to accelerate colonization, and will continue to look for additional opportunities to enhance the development of a band of dune grass at the base of the slope. No corrective actions appear necessary at this time. The area will be monitored again during Year 10.

There were no concerns with the CDF cap or berm identified during this qualitative inspection. The property owner continues to store logs and other equipment on the CDF cap.

**Middle Waterway Tideflat Habitat** – The Middle Waterway Tideflat Habitat with its associated mudflats and tidal channel was constructed on excavated uplands and existing tideflat along approximately 1,450 linear feet of the 1,800-foot long eastern shoreline of the Middle Waterway (see Figure 6-2). This habitat area begins immediately south of the relocated log haulout and immediately to the north of the existing Trustees/Simpson restoration project site along the southeast side of the waterway, and across Middle Waterway from the City's NRDA settlement restoration project and the Middle Waterway Action Committee shoreline restoration project.

The habitat area was excavated from elevations of 18 feet MLLW down to approximately 0 feet MLLW. A meandering tidal channel was excavated down to -4 feet MLLW at the north end, rising to -2 feet MLLW at the south end. The upper shoreline between 13 feet MLLW and 8 feet MLLW is enhanced with at least six inches of topsoil to support riparian plantings.

The marsh site is buffered from adjacent industrial activities with a 10- to 25-foot wide riparian area planted with native tree and shrub species and hydroseed. A freshwater sprinkler irrigation system initially irrigated the riparian area and continues to irrigate approximately 40,000 sq. ft. of the site between elevation 11.5 feet MLLW and 12.5 feet MLLW for the purpose of establishing brackish marsh habitat. Freshwater flow is required for the development and continued growth of the currently required emergent brackish marsh community at this habitat area. The brackish marsh is in the 10 feet MLLW to 13 feet MLLW elevation range, which varies between 10 and 60 feet in width. The irrigation system generally follows the 13 feet MLLW contour and is designed to reduce sediment pore water salinity in the elevation band between 11.5 feet MLLW and 12.5 feet MLLW. The City has proposed a discussion of the long term vision for this site with the agencies to determine whether the perpetual provision of fresh water to this area should be required and is currently awaiting response.

Twelve 10- by 50-foot (3- by 15-meter) nodes of brackish marsh species were originally planted in this zone. These plots were planted to stimulate development of a brackish marsh at the Middle Waterway Tideflat Habitat. Brackish marsh plantings consist of Lyngby's sedge (*Carex lyngbeyi*) and Seacoast bulrush (*Scirpus maritimus*). It was anticipated that these introduced brackish marsh plants would establish a seed source allowing expansion between the initial planting nodes over time, and this is consistent with observations.

Additional planting areas were constructed in 2009 as authorized by EPA to resolve additional habitat acreage owed by the City as a result of the remediation construction project. Some of these additional planting areas connected the existing nodes within the irrigated band. These areas were also planted with Lyngby sedge and Seacoast bulrush to accelerate colonization of the band. In addition, for added function and diversity, and to accelerate colonization of the upper intertidal area, the City also constructed planting nodes at the toe of the riparian slope and planted these areas with tufted hairgrass, gumweed, and coastal strawberry. Saltgrass was



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also intended to be placed in this area but was not available at the original time of the planting. The saltgrass was planted in December 2011 to fulfill the EPA requirements.

Four additional planting nodes were established at this site in spring 2007 to accelerate colonization. Two of these nodes were constructed north of the irrigated area, and two to the south. These nodes were planted with a combination of saltgrass, tufted hairgrass, and pickleweed. These added nodes are not subject to the performance standards for the site and are therefore not required to be monitored under the OMMP.

Performance standards for this site include minimal change in elevation over time; development of a brackish marsh and riparian vegetation cover; and juvenile salmonid presence. Performance standards are intended to ensure that created aquatic and riparian habitat are maintained over time, and to verify that habitat is not lost in the future.

Qualitative Ground Survey – The qualitative ground survey at this site was conducted on July 15, 2015. A copy of the completed field form can be found in Attachment E-1. Overall, the site was noted to be in excellent condition. Upon arrival, there were some small avian species and sand wasps present at the site. The wasps are generally non-aggressive, but it is important for site visitors to be aware of their presence. Those observed were in the northern half of the site. The transient camp located at the southern end of the site remains. The new property owner, Interfor, and the Tacoma Police Department have been notified.

In February 2013, the City notified EPA of a break in the sprinkler header line at the site. Upon discovery, the sprinklers were turned off and City maintenance crews were able to immediately cap off the break area so that the sprinklers for the south half could be turned back on. This issue was included in a letter that the City submitted to EPA in May 2013, and also discussed in the Year 7 OMMP Annual Report. After additional correspondence on this issue, the City is currently awaiting EPA direction on how or whether to repair this area and reconnect the northern portion of sprinkler system. During the Year 9 inspection, it was noted that the erosion area caused by this pipe break was continuing to heal naturally, with the area filling in and becoming less pronounced. Photographs of the area were taken for the record, and are included in Attachment E-2 of Appendix E along with photographs taken immediately after the break to show how the area has changed since the break occurred.

During the Year 9 inspection, it was noted that at the north end of the site near the log haulout facility, erosion of the slope is continuing to become more pronounced (see photos in Attachment E-2). Interfor representatives were notified due to the proximity of the eroded area to an adjacent light/power pole in the vicinity and have indicated that they will monitor the area. If the erosion in this area needs to be stabilized, planting of dune grass, or placement of rocks or LWD in the area could be considered. No other areas of erosion or sedimentation were observed during the Year 9 inspection.

There was no indication of animal damage or vegetative disease noted in either the marsh or riparian area. There were some indications of vandalism, primarily due to the continued presence of transients at the site. It appears that someone had been living in the sprinkler shed, and both the water system and the electrical system had sustained some damage. The individual is no longer present, and these issues have been corrected at this time and the sprinkler system is now functional again. As indicated above, there is also a transient camp present on the peninsula between the Middle Waterway Simpson site and the Middle Waterway Tideflat Habitat site. Trash is present throughout this area, and this was discussed with the

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Interfor representatives. Only very small amounts of trash were present in the tide line as well as typical amounts of wrack.

Remaining LWD pieces are generally in good condition and some additional LWD recruitment was observed throughout the site. Very small amounts of bark were present at the site, likely from the log haulout facility located north of the habitat area. It is estimated that the bark covered approximately 5% of the portion of the site between elevation 10 feet MLLW and 13 feet MLLW, with most occurring at the southern end of the site. The presence of bark does not appear to be affecting plant development as the amounts accumulated are so minimal.

The onsite soils were observed to be unchanged from the last monitoring event. The surface soils in the aquatic area consist of brown silty sand with some algae and fine grasses present in areas. The surface soils in the riparian area are brown topsoil/sandy silt. There was no indication of odor or sheen in the riparian area and only small areas of organic sheen with no associated odor in the intertidal area. Overall, there was no apparent site disturbance identified based on soil conditions and no deficiencies in soil conditions were identified.

The fence at the eastern edge of the site between the log haul road and the habitat area has been damaged again, possibly by a log. This damage is not impacting the habitat site in any way. Interfor was notified of this issue and has indicated that they will repair the fence.

The site was planted in accordance with the approved planting plans. A combination of Lyngby sedge and Seacoast bulrush were planted in 12 original planting nodes in the upper intertidal zone between elevation 11.5 feet MLLW and 12.5 feet MLLW. The planting area was expanded in 2009 as discussed above, by constructing additional nodes between the existing nodes, and planting with the same species to accelerate colonization. In addition, 10 nodes were constructed between 12.5 feet MLLW and the toe of the riparian slope. These areas were planted with a combination of tufted hairgrass, saltgrass, gumweed, and coastal strawberry. A combination of trees and shrubs, including black cottonwood, red alder, shore pine, Douglas fir, big-leaf maple, Hooker's willow, oceanspray, Sitka willow and red-flowering currant were planted in the riparian area.

It was noted during the inspection that all of the plants were doing very well, with continued growth and spreading of both established plants and volunteers. The sedges and rushes have continued to spread well since the last monitoring event. These plants are generally thriving more on the southern end of the site where the irrigation system was still intact until the disruption of irrigation as mentioned above. The grasses on the northern side are still surviving but are much smaller in mass. As expected, the vegetation palette appears to have fully transitioned in this now un-irrigated area from the planted brackish marsh species to those that are more common in a salt water marsh environment – mainly pickleweed and saltgrass.

Because of the success of the plants both in the marsh and in the riparian area, minimal weeds are present at the site, and only minor weeding is needed. No new volunteer species were observed in either the riparian or marsh areas.

Quantitative Vegetation Survey – Quantitative vegetation monitoring was not required during Year 9.

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Photo Documentation – Photo documentation was not required during Year 9. Some general photos of the site were taken during the inspection and those that aren't included in Attachment E-2 are available for review upon request.

Elevation Monitoring – Elevation monitoring was not required during Year 9.

Brackish Marsh Salinity Monitoring – Brackish marsh salinity monitoring as described in the OMMP is complete.

Juvenile Salmonid Monitoring – Juvenile salmonid monitoring as described in the OMMP is complete.

Invertebrate monitoring and water surface elevation monitoring are not required at this mitigation site.

**Puyallup River Side Channel** – The Puyallup River Side Channel (PRSC) provides off-channel habitat intended for use by juvenile salmonids for rearing and refuge during their outmigration to the estuary (see Figure 6-3). The project merged an existing isolated wetland and an adjacent parcel that was excavated to as deep as -2 feet MLLW from existing uplands, into a single off-channel habitat area. The existing flood control levee structure was breached following construction of a new levee to allow the river and the associated tidal hydrology to enter. The excavated channel and reconfigured existing wetland contain water during most tides.

A substantial area was left between about 6 feet MLLW and 13 feet MLLW to allow development of brackish marsh and riparian assemblages. The area on the inside of the existing Puyallup River dike has been planted with riparian vegetation. The mudflat areas below Ordinary High Water (OHW) have been left for natural colonization by native brackish marsh species (as occurred at the Gog-Le-Hi-Te site across the river).

Additional plantings were put in at the site in 2009. First, as described above, the original design documents required that four additional planting nodes be established at the North Beach Habitat site in the first or second spring following construction to accelerate colonization. Due to site conditions at North Beach, the City requested that two of these required nodes be relocated to the Puyallup River Side Channel. The agencies approved this request, so two nodes were placed at this site at the upstream and downstream ends at approximate elevation 11 feet MLLW to 13 feet MLLW in fall 2009. These added nodes are not subject to the performance standards for the site and are therefore not required to be monitored under the OMMP.

Second, additional plantings were authorized by EPA to resolve additional habitat acreage owed by the City as a result of the remediation construction project. Additional plantings were placed in the riparian areas on both the old and new levee structures. On the old levee, the existing planting area was enhanced with additional trees and shrubs, and the 3-foot walking path was eliminated by planting. The waterward slope of the new levee was planted over an approximately 10-foot width above approximate elevation 13 feet MLLW. All parties acknowledge that the area will be mowed by the Army Corps of Engineers on a routine basis for levee maintenance; however, the benefit provided to the habitat area between maintenance events made this area a priority for planting.

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Performance standards for this site include the development of riparian vegetation cover and juvenile salmonid presence. Performance standards are intended to ensure that created aquatic and riparian habitat are maintained over time, and to verify that habitat is not lost in the future. Since the purpose of the additional plantings on the old levee was to accelerate colonization, the performance standards for area-weighted average cover were increased for this area. Because of the routine maintenance of the new levee section, there are no performance standards associated with the plantings in this area.

Qualitative Ground Survey – The qualitative ground survey at this site was conducted on July 15, 2015. A copy of the completed field form can be found in Attachment E-1. Overall, the site was noted to be in excellent condition. At the time of the survey, the stream flow in the Puyallup River was 1,590 cfs, and the gauge height was 10.67 ft. at the USGS River monitoring station 12101500, identified as “Puyallup River at Puyallup, WA”.

Upon arrival, there were crows, seagulls, geese, caterpillars and small avian species present at the site. There were some individuals residing at the site in two different campsites on the upstream portion of the old levee section. A significant amount of garbage associated with this transient activity was noted. The City will refer this ongoing issue to its Homeless Services Manager for follow up. In addition, ecology blocks were placed at both the entrance to the site off of Portland Avenue and the Lincoln Avenue entrance to prevent illegal vehicular access.

No new areas of erosion were observed within the side channel. Some sediment continues to accumulate in the side channel area, particularly in the upstream end and near the breach opening, but the inlet remains open and passable at all times and the areas of accumulation are similar to those noted previously. There were some tent caterpillars observed and was also evidence of willow borer. There was no other indication of animal damage or disease at the site. There were some cleared areas as well as trash noted due to transient activity at the site. Some organic materials (sticks, branches) as well as some small logs continue to accumulate in the downstream end of the site, with amounts similar to that noted in past inspections.

The onsite soils were observed to be unchanged from the last monitoring event. The surface soils in the upland area are gray and sandy, while surface soils in the aquatic area are brown and silty. There was no indication of odor or sheen in either the upland area or the aquatic area. Habitat mix/fine grained material remains in place at the surface at the toe of the slope, and is covered with a thin layer of fine silt and algae. Overall, there was no apparent site disturbance identified based on soil conditions and no deficiencies in soil conditions were identified.

The site was originally planted in accordance with the approved planting plans. A combination of trees and shrubs, including black cottonwood, red alder, shore pine, Douglas fir, big-leaf maple, Hooker's willow, oceanspray, red-flowering currant and Sitka willow were planted on the top of the old, cutdown levee. As indicated above, additional plantings in the riparian area on both the old and new levees were placed in 2009. The old levee was enhanced with black cottonwood, red alder, shore pine, Douglas fir, big-leaf maple, Hooker's willow, oceanspray, red-flowering currant, red-osier dogwood and Sitka willow. These newer plantings are doing very well, and although the pathway is being used by the transients present at the site, the surviving plants have gotten much larger and most of the previously existing pathway is no longer apparent at this time. Species planted on the waterward face of the new levee include Sitka and Hooker's willow, red alder, red-osier dogwood, snowberry and Nootka rose. It was noted during the inspection that overall on the old levee the riparian plants were doing very well, and

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both original and newer plants are growing and spreading well. The plants on the new levee were not doing as well with the alder and willow showing better success than the red-osier dogwood. A significant amount of butterfly bush is present on the new levee. It does not appear that the ACOE has mowed the waterward face of the new levee recently, but based on their usual maintenance schedule, they will likely be doing that in the near future.

As noted above, additional planting nodes were placed in the upper intertidal area in fall 2009 and were planted with Lyngby's sedge. During the inspection it was noted that there was very little to no success of the carex within these node areas, however some carex was observed farther in the point of the downstream end of the site. Rushes were observed as before on the east side of the project at the high water line. No new volunteer plants were identified in the riparian area during the inspection. Some invasive species, primarily white sweet clover were observed. Minor weeding of this site is therefore required.

Quantitative Vegetation Survey – Quantitative vegetation monitoring was not required during Year 9.

Photo Documentation – Photo documentation was not required during Year 9. Some general photos of the site were taken during the inspection and are available for review upon request.

Elevation Monitoring – Elevation monitoring was not required during Year 9.

Invertebrate Monitoring – Invertebrate monitoring as described in the OMMP is complete.

Juvenile Salmonid Monitoring – Juvenile salmonid monitoring as described in the OMMP is complete.

Brackish marsh salinity monitoring and water surface elevation monitoring are not required at this mitigation site.

**Hylebos Creek Mitigation Site** – Hylebos Creek is the major tributary to the Hylebos Waterway. The project area is located on the east bank of lower Hylebos Creek. Hylebos Creek has a large watershed, the majority of which extends north into King County. The project site is bordered by the 4<sup>th</sup> Street Bridge at its southern end and the stream reach lies completely within the saltwater wedge associated with Commencement Bay's tidal prism. Approximately 400 feet of creek reach is within the project area. The total project area includes a riparian/forested wetland enhancement and created aquatic habitat (see Figure 6-4). Also included within the project is a habitat conservation easement that is associated with Parcel No. 420062176 located directly across the creek.

On-site native vegetation includes Oregon ash, red osier dogwood, salmonberry and black cottonwood. This project complements the neighboring restored areas, including the Milgard mitigation project and the NRDA Trustees' Jordan project. Both projects are located upstream of the Hylebos Creek Mitigation Site. The Jordan project is designed to provide off-channel salmon habitat to the east of the creek's bank, while the Milgard project restored the creek's western wetland buffer. Additional sites present downstream near the mouth of Hylebos Creek include the Hauff site (NRDA/Trustee), the Place of Circling Waters (Port of Tacoma), a WSDOT mitigation site and the Mowitch site (NRDA/Trustee). The Hylebos Creek Mitigation Site adds to the area's habitat value and extends the wildlife corridor already established through restoration both upstream and downstream.

Habitat in this area was enhanced within a linear band paralleling Hylebos Creek. Enhancements included removal of non-native invasive Himalayan blackberry, reed canary grass, and yellow-flag iris. These species were replaced with native plants appropriate to the new hydrological regime, including Sitka willow, Sitka spruce, Nootka rose, mock orange, Hooker's willow and oceanspray. While much of the reed canary grass and yellow-flag iris were removed during construction, they still exist at the site due to a large parent source upstream.

Where possible with the least disturbance to native vegetation, small channel "fingers" were excavated into the existing bank to allow water inundation during periods of high freshwater flows or tidal surges. The off-channel area provides habitat for the creek's out-migrating juvenile salmonids that need refuge areas while acclimatizing to saltwater. The added aquatic habitat, water retention and wetland enhancement provide a more diverse habitat and increased wildlife protection by screening it from the adjacent open areas. Preservation of the existing mature native bankside vegetation allows for the continued contribution of leaf litter, shade, and nutrients to the creek.

Performance standards for this site include minimal change in elevation (average change along centerline transect of channels less than 0.2 feet from as-built elevations); development of forested wetlands vegetative cover and juvenile salmonid presence. Performance standards are intended to ensure that created aquatic habitat is maintained over time, and to verify that habitat is not lost in the future.

Qualitative Ground Survey – The qualitative ground survey at this site was conducted on July 15, 2015. A copy of the completed field form can be found in Attachment E-1. Overall, the site was noted to be in excellent condition. At the time of the qualitative inspection, the stream flow in the Puyallup River was 1,630 cfs with a corresponding gauge height of 10.72 feet at the USGS River monitoring station 12101500, identified as "Puyallup River at Puyallup, WA".

Upon arrival, there were some small avian species, jellyfish, and bees present at the site, along with evidence of beaver. No new or significant erosion or sedimentation was identified at the site. There was no indication of disease noted with the possible exception of crinkly new growth on the willows in the marsh area. In addition, minor, possibly old beaver damage was observed. There was no significant trash present or any vandalism observed. There were no significant wrack or organic material accumulations observed. The LWD were present and in good condition and no maintenance actions were identified. Some additional minor recruitment of wood debris was also noted in the channels.

The onsite soils were observed to be unchanged from the last monitoring event. The upland surface soils are brown topsoil and surface soils in the aquatic areas are brown silty sand. There was no indication of odor or sheen in either area. No obstruction to fish passage in the channels was observed. Overall, there was no apparent site disturbance identified based on soil conditions and no deficiencies in soil conditions were identified.

The site was planted in accordance with the approved planting plans. The upland forest was planted with a variety of trees and shrubs, including Douglas fir, Sitka spruce, big-leaf maple, shore pine, thimbleberry, oceanspray, snowberry, mock orange, kinnickinick, western service berry, baldhip rose and bracken fern. Erosion control hydroseed mix was also applied at the site. This portion of the site is in excellent condition, with conifers doing very well and no maintenance activities identified, with the exception of removal of blackberry on the northern



end of the project. Blackberry has been removed from an additional area at the top of the riparian slope on the east side and some natives have been planted. Additional planting of this area is planned for fall 2015.

The forested wetland portion of the site was also planted with a combination of trees and shrubs, including red alder, Oregon ash, western red cedar, black cottonwood, western crabapple, beaked hazelnut, Pacific ninebark, black twinberry, vine maple, red-osier dogwood, Hooker's willow and Sitka willow. The willows that were staked along the creek are doing very well. The forested wetland portion of the site appears to be thriving with plants growing and spreading and no required maintenance activities other than invasive control were noted. Several willows and alder have fallen into the marsh area, providing shade and diversity without blocking fish passage.

The emergent wetland was planted with a combination of sawbeak sedge, slough sedge, small-fruited bulrush, hardstem bulrush and reed mannagrass. This portion of the site appears to be well established with a very high aerial coverage (estimated). No required maintenance activities other than invasive control were identified.

Some invasive weeds were identified at the site, including reed canary grass, yellow flag iris, teasel, knotweed, pepperweed and purple loosestrife, and minor weeding as a part of regularly scheduled maintenance is needed. In general, invasive species control will be an ongoing issue at this site as there are significant parent sources for these invasive weeds upstream of the site.

Quantitative Vegetation Survey – Quantitative vegetation monitoring was not required during Year 9.

Photo Documentation – Photo documentation was not required during Year 9. Some general photos of the site were taken during the inspection and are available for review upon request.

Elevation Monitoring – The survey of the centerline transects in the north and south nodes was performed between September 9, 2015 and September 11, 2015. A summary of the survey information is shown on Figure 6-9, and the survey data are included in Attachment E-3. Figure 6-10 includes transects which show the elevations from this Year 9 survey, along with the design and as-built centerline elevations within the north and south nodes. As depicted on Figure 6-10, the contractor built the lobes deeper than the approved design depths, and the as-built elevations of the lobes at the site were an average of 0.84 feet deeper in the north lobe and 1.14 feet deeper in the south lobe as compared to the design elevations. Between the time that construction of this site was completed in September 2005 and the time of the baseline survey of the elevation stakes in the nodes was completed in July 2006, the site had silted in to reach equilibrium conditions such that the elevations at Year 0 were closer to, but still below the approved design elevations at all but one location surveyed (near the mouth of the north lobe).

According to the OMMP, the performance criteria relative to elevation changes at this site indicate that the average elevation change along the centerline transect of the channels must be less than 0.2 feet from the as-built elevations. Based upon this criteria, the south lobe does not meet this performance criteria (average Year 9 change in south lobe relative to as-built elevations was 0.6 feet) while the change in the north lobe relative to as-built elevations was 0.37 feet (Table 6-5). However, when the elevations are compared to either the design elevations or the Year 0 elevations, both lobes meet the performance criteria with the south lobe

an average of 0.53 feet deeper than designed and the north lobe an average of 0.47 feet deeper than designed.

As indicated in previous reports, the depth of the nodes at the Hylebos Creek Mitigation Site has been the subject of ongoing discussion since the completion of construction and was also included in the May 2013 letter to EPA outlining outstanding issues on the project. The Biological Opinion (BO) prepared for the project was finalized before plans for this mitigation project were developed, so no specific performance criteria for this site are included in that document. Because of this, performance criteria for this site were instead determined in the project description and the design plans. The project objectives as a whole for the Thea Foss Remediation Project were identified in the Design Analysis Report, and the overall project mitigation plan proposed by the City used the Simenstad Report (2000) as a reference for guiding the selection and design of habitat mitigation projects. One of the top priorities for habitat restoration identified by Simenstad was to restore off-channel, or blind-slough, habitat types in the lower river and estuary in order to improve habitat for migrating juvenile salmon. The Hylebos Creek Mitigation Site was developed with this as a consideration, and is providing function as a blind slough. Unfortunately, the agencies' expectations of the site features based upon their review of the plans and specifications, was not consistent with the actual approved design.

The project was constructed in accordance with the approved plans. As indicated above, during construction, at the contractor's discretion and as approved in the field, the channels were actually built deeper than the approved plans. Due to the established bottom elevation of the adjacent creek and the hydrodynamics of the site, between the time that construction of this site was completed in September 2005 and the time of the baseline survey of the elevation stakes in the nodes was completed in July 2006, the channel depths had equalized to that of the creek bottom such that the elevations at Year 0 were closer to, but still below the approved design elevations at all but one location surveyed (near the mouth of the north lobe). Since that time, the site appears to have reached equilibrium, since elevations within the channels at most locations have remained fairly consistent since the time of the baseline survey (see Table 6-5).

Other habitat assessment parameters for this site should be considered in determining the need for and value of any response actions relative to the failure to achieve this specific performance criteria. Please note that when the performance criteria were written it was not anticipated that the channels would be constructed deeper than the design elevations. Quantitative vegetation monitoring shows that the site vegetation far exceeds the performance criteria, which provides shading, detritus and refuge areas for juvenile salmonids. Invertebrate monitoring was performed during past monitoring events, which identified the presence of insects at the water surface, providing a food source for salmonid and other fish species. Water surface elevation monitoring performed for informational purposes during Year 7 shows that the water surface is greater than an elevation of 2.0 feet NVGD 29 approximately 46.8% of the time, which exceeds the goal of 30% of the time. The site was monitored for the presence of juvenile salmonids during the migration period during Year 1 and Year 3. Salmon were observed utilizing the site during the late May monitoring event in Year 1. They were not observed during Year 3 monitoring, however, fewer salmonids were observed at other sites during this monitoring year as well, indicating that other regional factors likely resulted in the reduced frequency of observation in Year 3 (see Year 3 Annual Report). Based upon consideration of all of these elements, the City believes that the site is achieving all of the functions outlined in the project description and design documents, which set forth the required functional elements for this site, and, therefore, no response actions are needed.

The City has recommended that the performance criteria for elevation monitoring at the Hylebos Creek Mitigation Site be modified to indicate that the average change along the centerline transect of the nodes will be less than 0.2 feet from the agency approved design elevation. EPA has indicated that it is willing to discuss this issue with the Adaptive Management Team, however, this has not yet occurred. Following those discussions, and upon agency agreement, Table 6-3 from the OMMP will be modified to reflect this change, and the updated table will be provided to the agencies in the OMMP revisions document.

Invertebrate Monitoring – Invertebrate monitoring as described in the OMMP is complete.

Juvenile Salmonid Monitoring – Juvenile salmonid monitoring as described in the OMMP is complete.

Surface Water Elevation Monitoring – Surface water elevation monitoring was not required during Year 9 monitoring.

Brackish marsh salinity monitoring is not required at this mitigation site.

**Johnny's Dock Habitat Enhancement** – This area is a pocket beach constructed to enhance the habitat between the Foss Landing and Johnny's Dock Marinas (see Figure 6-5). Prior to remediation, an old timber access pier with a brick foundation was present at the site. As part of construction of this habitat area, this structure was removed from the marine environment. A thick quarry spall cap consisting of an 18-inch deep layer of filter material overlain by an 18-inch deep layer of quarry spalls was then placed. Habitat mix was placed on the slope over the quarry spalls between elevations -10 feet MLLW and 13 feet MLLW. Saltmarsh vegetation was planted between 10 feet MLLW and 13 feet MLLW, and LWD was added to the slope to add complexity to the habitat feature. A goose exclusion grid was installed to minimize herbivory but has since been removed.

Qualitative Ground Survey – The qualitative ground survey at this site was conducted on July 14, 2015. A copy of the completed field form can be found in Attachment E-1. Overall, the site was noted to be in excellent condition. Geese and bees were present at the time of the inspection. Very minor erosion was noted including the sloughing of some gravel, but it is not impacting site success. No significant accumulation of sediments was observed throughout the site. Predation of the grasses by geese was noted (or could possibly be from a weed wacker), but there were no indications of disease, vandalism trash or wrack/organic material present. The LWD was found to be present and in good condition, although some of the anchors require tightening.

The onsite soils were observed to be unchanged from the last monitoring event. The surface soils are grey, gravelly sand habitat mix. There was no indication of odor or sheen. Overall, there was no apparent site disturbance identified based on soil conditions and no deficiencies in soil conditions were identified.

The site had been planted in accordance with the approved planting plans. A combination of pickleweed and saltgrass were planted between elevations 10 feet MLLW and 12 feet MLLW. Tufted hairgrass had been planted above that, between 12 feet MLLW and 13 feet MLLW. Saltgrass is the dominant planted species at the site, but it continues to be grazed significantly by the geese. A significant population of volunteer gumweed was noted along with a few

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## Section 6.0 – Habitat Mitigation Area Monitoring

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potentilla plants during this monitoring event. There were no invasive species identified during the inspection.

Photo Documentation – Photo documentation was not required during Year 9 monitoring. Some general photos of the site were taken during the inspection and are available for review upon request

**Head of Thea Foss Shoreline Habitat** – A portion of the eastern shoreline at the head of the waterway was cut back as part of the Utilities' remediation project, to create aquatic habitat below ordinary high water (see Figure 6-6). Saltmarsh and littoral vegetation were planted in a 5- to 8-foot side strip landward of a log step structure (at approximately 12.4 feet MLLW) along the shoreline. A goose exclusion grid was constructed across the area to minimize herbivory but has since been removed.

Qualitative Ground Survey – The qualitative ground survey at this site was conducted on July 14, 2015. A copy of the completed field form can be found in Attachment E-1. Overall, the site was noted to be in excellent condition. Upon arrival, there were some small avian species, geese, pigeons, seagulls, ducks, crows, bees and grasshoppers present at the site. No significant erosion or sedimentation was identified. There were no indications of animal damage or vandalism at the site; however the presence of willow borer damage was noted. There was no wrack or organic material observed, but some trash was present associated with the tideline, particularly at the south end. The log step is present and appears to be in good condition. The anchors should be checked and tightened as needed.

The onsite soils were observed to be unchanged from the last monitoring event. The surface soils are grayish-brown silty sand. There was no indication of odor or sheen. Overall, there was no apparent site disturbance identified based on soil conditions and no deficiencies in soil conditions were identified.

The site had been planted in accordance with the approved planting plans as modified following baseline monitoring. All of the planted species are showing some drought impact but are continuing to do well and have filled in the bench area nicely with willows, tufted hairgrass, rose and potentilla dominant. There are no willows at the north end of the site. Volunteer cottonwood, beach rose and gumweed were also noted. As noted in the Year 8 report, some vegetation was removed at the north end of the site during the recent remediation of the American Plating site. The area was subsequently replanted but the plants are generally still not doing well. Of the planted species, only some roses were noted to have become established in this area. In addition, the City performed some supplemental planting south of the site, and those are also doing well.

There were pepperweed plants observed as well as some blackberry, St. John's wort, white sweet clover, knapweed, nightshade, dock, poison hemlock and tansy in minor amounts. Phragmites was also observed and the plants were flagged for removal. Minor weeding is therefore needed throughout the site.

Photo Documentation – Photo documentation was not required during Year 9 monitoring. Some general photos of the site were taken during the inspection and are available for review upon request.

**SR 509 Esplanade Riparian Habitat** – Upland vegetation was planted above the ordinary high water level along the shoreline south of Alber's Mill (see Figure 6-7). In order to account for shading by the SR 509 Bridge, two different assemblages of riparian vegetation were planted: one tree and shrub assemblage appropriate for full sun exposure, and a shrub assemblage appropriate for partial shade. An irrigation system was initially constructed under the bridge in the shaded area and was subsequently extended to the north and south ends of the enhancement area. Construction of a park on the adjacent property was completed in 2009. The sprinkler system for the habitat site has now been incorporated into the overall park sprinkler system, although there have been issues with the system since incorporation. The planting area has been extended south of the habitat site as part of overall site landscaping.

Qualitative Ground Survey – The qualitative ground survey at this site was conducted on July 14, 2015. A copy of the completed field form can be found in Attachment E-1. Overall, the site was noted to be in good condition. Vegetation outside of the bridge shadow is quite dry, but generally continuing to do quite well while those under the bridge are nearly non-existent. Upon arrival at the site for the qualitative inspection, there were some geese, a dog, a snake and small avian species present. A dead rat was also seen as well as a sculpin in the shallow water near the outfall that was exhibiting feeding behaviors. No significant sedimentation or erosion were identified. There was no indication of animal damage or disease present, and only minor trash observed, likely associated with ongoing transient and other human activity at the site. There was no indication of vandalism at the site, other than the presence of the trail at the high water line which was noted in previous reports. This trail is quite well established and has been extended down past the end of the site to the dock structure. The back edge of the trail appears to have uncovered a fair amount of concrete and other debris. The sprinkler system needs to be inspected to ensure that it is in good, working order for this area.

The onsite soils were observed to be unchanged from the last monitoring event. The surface soils are grayish-brown, silty sand and topsoil. There was no indication of odor or sheen. Overall, there was no apparent site disturbance identified based on soil conditions and no deficiencies in soil conditions were identified.

The site had been planted in accordance with the approved planting plans. As indicated above, two different assemblages were originally planted due to the shading provided by the SR 509 Bridge. In the area with full sun, a combination of Pacific madrone, shore pine, oceanspray, red-flowering currant and tall Oregon grape had been planted. In the shaded area beneath the bridge, a combination of Pacific rhododendron, salal, and red huckleberry were planted. The plants in the unshaded areas, particularly the red flowering currant, shore pine, Oregon grape, coastal strawberry and oceanspray, are doing very well, while those under the bridge are not thriving at all. Volunteer gumweed, pickleweed, fleshy jaumea, orache, goosefoot and cottonwood were identified during the inspection. Invasive species noted include curled dock, pepperweed, poison hemlock, Himalayan blackberry mustard and borage. Ongoing weeding of the site is needed.

Photo Documentation – Photo documentation was not required during Year 9 monitoring. Some general photos of the site were taken during the inspection and are available for review upon request.

**Log Step Habitat Enhancement** – Approximately 35 treated timber piling, a 12- by 14-foot concrete vault, and other debris were removed from an area on the west side of the waterway between the Colonial Fruit warehouse and the Foss Harbor Marina. A portion of the area was

dredged, and a thick quarry spall cap consisting of 18 inches of filter material overlain by 18 inches of riprap was constructed. Habitat mix was placed over the area between the elevations of -10 feet MLLW and 11 feet MLLW (see Figure 6-8).

A 2-step log transition was constructed between elevations 11 feet MLLW and 13 feet MLLW and a 3-foot bench was constructed using 18 inches of filter material overlain with an 18-inch deep layer of quarry spalls. Habitat mix was placed over the quarry spalls, and saltmarsh grasses planted at elevation 13 feet MLLW along the 65-foot long high intertidal bench.

Qualitative Ground Survey – The qualitative ground survey at this site was conducted on July 14, 2015. A copy of the completed field form can be found in Attachment E-1. Overall, the site was noted to be in good condition. Upon arrival, there were Caspian terns and seagulls heard nearby. It appeared that private grounds maintenance crews had recently removed invasives on the adjacent site to the south as well as the parking area. No significant sedimentation and only minor erosion behind the logs were identified. There were no indications of animal damage, disease or vandalism, and only minor amounts of trash, wrack and organic debris noted associated with the tide. The log step appeared to be in good condition and only minor maintenance, including checking the anchors on the logs, is needed.

There was no change in the surface soils noted at the site and there was no indication of odor or sheen. Overall, there was no apparent site disturbance identified based on soil conditions and no deficiencies in soil conditions were identified.

The site had been planted in accordance with the approved planting plans. A combination of American dunegrass and tufted hairgrass was planted in a 3-foot wide bench behind the log step at an elevation of approximately 13 feet MLLW. It was noted during the inspection that the dunegrass is continuing to do very well and is clearly the dominant species at the site, although it was much more sparse than has been previously observed, likely due to the heat and drought conditions. There was no tufted hairgrass observed. Pickleweed, gumweed, orache and goosefoot are volunteering at the site, with the pickleweed doing particularly well and spreading down the shoreline. The only invasive species present was a single Himalayan blackberry observed in the riprap. Therefore, only minor weeding is needed.

Photo Documentation – Photo documentation was not required during Year 9 monitoring. Some general photos of the site were taken during the inspection and are available for review upon request.

### 6.2.3 Summary of Findings from Habitat Mitigation Area Monitoring

The primary performance criteria for the mitigation sites is the maintenance of the total habitat acreage for the project. The habitat enhancement areas were designed to enhance the habitat function where possible within the remediated areas, and specific long-term performance criteria for these sites are not applicable.

Very few follow-up actions were identified during this monitoring event. Those that were identified are discussed in the sections above, and are summarized in Table 6-4.

An evaluation of whether each of the mitigation sites meets the applicable performance criteria for Year 9 is provided below and summarized in Table 6-6.



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North Beach Habitat – The only identified Year 9 performance standard for this site is presence of habitat mix at the surface. Habitat mix was observed and measured with a probe on the beach surface so this performance criteria is met.

Middle Waterway Tideflat Habitat – There are no Year 9 performance standards for this site.

Puyallup River Side Channel – The only identified Year 9 performance standard for this site is presence of fine-grained material in the interstices of the riprap between elevations 13 feet MLLW and 9 feet MLLW. Fine-grained material was observed so the site meets this performance criteria.

Hylebos Creek Mitigation Site – Year 9 performance standards for this site include minimal change in elevation and no obstruction of fish passage in the channels. The performance standard relative to elevation in the channels at this site indicate that the average elevation change along the centerline transect of the channels must be less than 0.2 feet from as-built elevations. Based upon this criteria and as described in detail above, the site does not meet the performance standard (average Year 9 change in the south lobe relative to as-built elevations was 0.6 feet and in the north lobe was 0.37 feet). However, if the elevations are compared to either the design elevations or the Year 0 elevations, the site does meet the performance criteria.

No obstruction to fish passage was observed in the channels, so the site meets this performance criteria.

### 6.2.4 Schedule of Habitat Mitigation Area Monitoring Activities

The next round of habitat mitigation area monitoring activities is scheduled for Year 10. Year 10 monitoring activities are summarized in Table 6-7 and include quantitative and elevation monitoring at the mitigation sites, and qualitative site surveys and photo documentation at both the mitigation sites and the enhancement sites. In addition, water surface elevation monitoring for informational purposes is scheduled to be conducted at Hylebos Creek, although this issue was included in the City's May 2013 letter to EPA referenced above. These activities are scheduled to be conducted in June or July 2016, during appropriate tidal cycles.

## 6.3 Habitat Mitigation Area Maintenance

### 6.3.1 Maintenance Approach

As indicated above, routine maintenance of the habitat mitigation and enhancement sites is performed for the City by the WCC crew. Both City staff and WCC have visited the sites periodically during the year for informal inspections and maintenance, as well as specifically following up on issues identified during the qualitative site surveys.

### 6.3.2 Completed Maintenance Activities

Since the performance of the qualitative site inspections in July 2015, the WCC has begun following up on the maintenance issues identified in Table 6-4. Specifically, they have performed the following activities:

- Watered plants at North Beach;

- Removed rebar from the island at North Beach;
- Picked up trash as needed from all sites; and
- Removed invasives at all sites as needed.

In addition, City crews repaired the power supply to the sprinkler system for the Middle Waterway Tideflat Habitat, and got the marsh system back up and operational. The riparian system, which has not been operated for several years, was capped off and taken out of service.

### **6.3.3 Replanting Performed as Part of Maintenance Activities**

Under the approved OMMP, replanting of the sites will generally be performed as a contingency action if, upon completion of quantitative evaluations, it is determined that plant coverage is less than the performance standards. Based upon the Year 7 quantitative vegetation survey and as discussed in the Year 7 OMMP Annual Report, the vegetation performance standards for two metrics were not achieved:

- Area Weighted Percent Cover for the salt marsh at the North Beach Habitat; and
- Area Weighted Percent Cover for the brackish marsh at the Middle Waterway Tideflat Habitat.

In the Year 7 OMMP Annual Report, the City provided a discussion of the conditions at each of these sites that contributed to the areas not meeting these performance standards. In both cases, it was recommended that the Area Weighted Percent Cover be considered in conjunction with the GPS delineation of the plant growth in the marsh areas of the sites to gauge overall success. Based on that evaluation, both areas showed increases in the overall area of new growth. The vegetation was present and spreading in the areas that were naturally most conducive to survival. Therefore, the City's recommendation was reassess these areas qualitatively in Years 8 and 9 and then quantitatively in Year 10.

A qualitative assessment of each of these areas was performed during Year 8 monitoring and again this year as a part of Year 9 monitoring. At the North Beach habitat, the vegetation within the marsh area continues to do well, particularly in the higher intertidal zone near the toe of the slope. Pickleweed is present throughout the area, with numerous small plants in the bare areas as well as large clumps in the areas where it has become well established over time. It appears that these areas are healthy and that the marsh plants are establishing naturally where the site conditions are most conducive to survival. At the Middle Waterway Tideflat, the upper intertidal marsh is also well established and provides a near complete band of vegetation throughout the site. As discussed in Section 6.2.2, the makeup of the plants in this vegetated band is evolving in the areas of the site that are not currently irrigated. Despite the change in the makeup of the vegetation, the area appears well-established and no supplemental planting is recommended at this time. The City will continue to observe these areas and will perform the next required quantitative monitoring event in these areas in Year 10. In the event that it is apparent from these monitoring events that additional plantings are warranted, the City will provide a proposal and recommendation to the agencies for consideration.

In the past year, the City has performed some supplemental planting at various locations. Additional dune grass was placed in several pocket areas on the water side of the containment

berm at the North Beach habitat area where erosion has occurred. These plants are continuing to establish well and the patches of established grasses are nicely spaced along the berm. Additional riparian plants were also placed at North Beach to fill in gaps where plants have been difficult to establish. This will continue to provide stabilization of this slope area as well as diversity for the habitat area. Some additional riparian plants were installed at Puyallup River Side Channel where vegetation had been removed or disturbed due to transient activity. Finally, at the Hylebos Creek habitat area, additional trees and shrubs were placed on the plateau area above the riparian slope on the east side of the site.

During the Year 9 qualitative inspection, it was determined that additional riparian plantings would be beneficial in several areas. At North Beach, additional Douglas fir and shore pine will be placed in the riparian area north of the log haulout as well as along the front of the containment berm, particularly on the east end. Additional willows may also be placed along the edge of the riparian area where existing willows have been damaged by the willow borers, although there has been limited success with willows at this location in the past. Additional riparian plants may be placed at the Puyallup River Side Channel in areas of transient disturbance if there is success in keeping the transients vacated from this location. Finally, at the Hylebos Creek habitat area, additional trees and shrubs will be placed on the plateau area above the riparian slope on the east side of the site. These plantings will occur in fall 2015.

Finally, in a letter dated February 8, 2007, EPA set forth a demand to the City for an additional 0.63 acres of habitat mitigation. This additional mitigation area was required in part as a condition of a time extension allowed during the Thea Foss sediment remediation project and also due to a delay in completing construction of all mitigation areas. Following additional discussion of this issue, the City submitted a proposal for fulfilling this habitat requirement. EPA approved this proposal on October 13, 2009. The proposal included enhancement of the riparian areas at the North Beach Habitat and Puyallup River Side Channel, and enhancement of the marsh area at the Middle Waterway Tideflat Habitat. All plantings were completed as of December 2011. The City received concurrence from EPA that the plantings have been completed satisfactorily, and these areas are being monitored in accordance with the OMMP.

#### **6.4 Contingency Planning and Response Actions**

The approach to adaptive management and contingency planning are set forth in Sections 6.4 and 6.5 of the OMMP, respectively. In a letter to EPA dated May 22, 2013, the City identified several habitat related issues which required resolution. In their June 27, 2013 response, EPA indicated that it would like to have these issues considered by the Adaptive Management Team (AMT). At this time, it is the City's understanding that agency representatives are discussing these issues internally and the City is awaiting response.

There are no ongoing or new issues identified at this time that are being actively considered in the adaptive management and contingency planning processes.

**TABLES**

6-1 – Year 9 Monitoring Activities

6-2 – Mitigation Area Acreage

6-3 – Survey Information for Photo Points and Elevation Stakes

6-4 – Summary of Findings from Year 9 Habitat Mitigation Area Monitoring

6-5 – Hylebos Creek Transect Elevations

6-6 – Year 9 Performance Standard Schedule by Site

6-7 – Year 10 Monitoring Activities

**FIGURES**

6-1 – North Beach Habitat

6-2 – Middle Waterway Tideflat Habitat

6-3 – Puyallup River Side Channel

6-4 – Hylebos Creek Mitigation Site

6-5 – Johnny's Dock Habitat Enhancement

6-6 – Head of Thea Foss Shoreline Habitat

6-7 – SR 509 Esplanade Riparian Habitat

6-8 – Log Step Habitat Enhancement

6-9 – Hylebos Creek Habitat Quantitative Monitoring Locations

6-10 – Hylebos Creek Centerline Transect Elevation Comparison

**Table 6-1  
Year 9 Monitoring Activities**

	North Beach Habitat	Middle Waterway Tideflat Habitat	Puyallup River Side Channel	Hylebos Creek Mitigation Site	Thea Foss Enhancement Areas
Qualitative Ground Survey	x	x	x	x	x
Photo Documentation	--	--	--	--	--
Quantitative Vegetation Monitoring	--	--	--	--	n/a
Invertebrate Monitoring	n/a	n/a	TC	TC	n/a
Elevation Monitoring	--	--	--	--	n/a
Water Surface Elevation Sampling	n/a	n/a	n/a	--	n/a
Brackish Marsh Salinity Monitoring	n/a	TC	n/a	n/a	n/a
Juvenile Salmonid Monitoring	TC	TC	TC	TC	n/a

x      activity required  
 --     activity not required this monitoring year  
 n/a    activity not required at this location  
 TC     task completed

**Table 6-2**  
**Mitigation Area Acreage**

Site	Subtidal, acres (Below -10 feet MLLW)	Littoral, acres (Between OHW and -10 feet MLLW)	Total Aquatic Habitat, acres	Riparian, acres
North Beach Habitat	0.10	7.26	7.36	0.30
Middle Waterway Tideflat Habitat	--	8.84	8.84	0.55
Puyallup River Side Channel	--	5.39	5.39	0.44
Hylebos Creek Mitigation Site	--	0.58	0.58	0.30

<sup>1</sup> At the Hylebos Creek Mitigation Site, the riparian area subject to performance monitoring is identified as forested wetland (see Figure 6-4).

**Table 6-3**  
**Survey Information for Photo Points and Elevation Stakes**

Site	Photo Point Identification	Elevation Stake Identification	Coordinates	Elevation Top of Stake	
				Top of Stake	Depth from Top of Stake to Sediment Surface
North Beach Habitat	P-1		710023.3 / 1161327		
	P-2		709994.3 / 1161228		
	P-3		709909.6 / 1160964		
	P-4		709869.5 / 1160958		
	P-5		709671.7 / 1160934		
	P-6		710551.3 / 1160645		
		E-1	710056.7 / 1161259	-0.689	1.07
		E-2	710001.4 / 1161054	8.207	1.09
		E-3	709900.2 / 1160916	5.383	0.68
		E-4	709818.6 / 1160941	5.984	1.02
		E-5	709742.3 / 1160912	3.442	1.05
Middle Waterway Tideflat Habitat	P-1		708961.1 / 1161384		
	P-2		708534.1 / 1161575		
	P-3		708040.6 / 1161800		
	P-4		707863.4 / 1161619		
		E-1	708976.1 / 1161325	6.801	1.05
		E-2	708792.6 / 1161327	0.398	1.05
		E-3	708545.3 / 1161470	-1.133	1.05
		E-4	708494.6 / 1161558	5.429	1.02
		E-5	708269 / 1161523	0.003	1.05
		E-6	707981.6 / 1161745	5.548	1.05



Site	Photo Point Identification	Elevation Stake Identification	Coordinates	Elevation Top of Stake	
				Top of Stake	Depth from Top of Stake to Sediment Surface
Puyallup River Side Channel	P-1		706460.3 / 1164098		
	P-2		706548.9 / 1164081		
	P-3		706064.8 / 1163970		
	P-4		705490.6 / 1164036		
	P-5		705143.7 / 1164421		
	P-6		705321.7 / 1164354		
		E-1	706461.3 / 1164073	6.273	1.06
		E-2	706278.4 / 1164065	3.089	1.03
		E-3	706109.5 / 1164066	1.68	1.05
		E-4	705269.5 / 1164313	0.563	1.06
		E-5	705220.3 / 1164352	2.443	1.05
		E-6	705180.7 / 1164385	4.414	1.08
Hylebos Creek Mitigation Site	P-1		706015.6 / 1181008		
	P-2		705967.8 / 1181125		
	P-3		705840.7 / 1181168		
	P-4		705733.2 / 1181050		
	P-5		705943.3 / 1181089		
	P-6		705787.3 / 1181053		
	P-7		705708.4 / 1181016		
		E-1	705743.9 / 1181053	2.483	1.07
		E-2	705904.4 / 1181079	2.474	1.05
		E-3	705819.2 / 1181135	6.49	1.07
		E-4	705869.6 / 1181162	3.829	1.07
		E-5	705955.1 / 1181110	2.97	1.07
		E-6	705999 / 1181026	2.763	1.03

Site	Photo Point Identification	Elevation Stake Identification	Coordinates	Elevation Top of Stake	
				Top of Stake	Depth from Top of Stake to Sediment Surface
Johnny's Dock Habitat Enhancement	P-1		703065.1 / 1160772		
	P-2		703022.6 / 1160731		
Head of Thea Foss Shoreline Habitat	P-1		702352.7 / 1160773		
	P-2		701860.2 / 1160780		
SR 509 Esplanade Riparian Habitat	P-1		702697.8 / 1160410		
	P-2		702498.2 / 1160286		
	P-3		702257.3 / 1160311		
Log Step Habitat Enhancement	P-1		705509.6 / 1160052		

Note: Horizontal Datum 83-91  
Vertical Datum NGVD 29

**Table 6-4**  
**Summary of Findings from**  
**Year 9 Habitat Mitigation Area Monitoring**

Site	Corrective Action Tasks
North Beach Habitat	<ul style="list-style-type: none"> <li>- Water riparian plants as needed</li> <li>- Ongoing minor weeding / trash removal</li> <li>- Placement of additional riparian plants on berm</li> <li>- Check/tighten/replace anchors on large woody debris (LWD)</li> <li>- Remove rebar from the island area</li> </ul>
Middle Waterway Tideflat Habitat	<ul style="list-style-type: none"> <li>- Ongoing minor weeding / trash removal</li> <li>- Check LWD anchors and tighten anchors as needed</li> <li>- Remove vegetation that is encroaching on the fenceline</li> <li>- Repair irrigation system</li> </ul>
Puyallup River Side Channel	<ul style="list-style-type: none"> <li>- Ongoing minor weeding / trash removal</li> <li>- Ongoing site check for transient activity</li> <li>- Place additional riparian plants if possible depending on transient activity</li> </ul>
Hylebos Creek Mitigation Site	<ul style="list-style-type: none"> <li>- Ongoing minor weeding / trash removal</li> <li>- Check LWD anchors and tighten anchors as needed</li> <li>- Remove blackberry that is encroaching on the north side of the project</li> <li>- Place additional trees and shrubs on the plateau</li> </ul>
Johnny's Dock Habitat Enhancement	<ul style="list-style-type: none"> <li>- Ongoing minor weeding / trash removal</li> <li>- Tighten anchors as needed on LWD</li> </ul>
Head of Thea Foss Shoreline Habitat	<ul style="list-style-type: none"> <li>- Ongoing trash removal / minor weeding, especially phragmites and tansy</li> <li>- Check LWD anchors and tighten anchors as needed</li> </ul>
SR 509 Esplanade Riparian Habitat	<ul style="list-style-type: none"> <li>- Ongoing minor weeding / trash removal</li> <li>- Remove dead vegetation and weedeat around plants</li> <li>- Check sprinkler system to ensure proper function</li> </ul>
Log Step Habitat Enhancement	<ul style="list-style-type: none"> <li>- Ongoing minor weeding / trash removal</li> <li>- Check LWD anchors and tighten anchors as needed</li> </ul>

**Table 6-5  
Hylebos Creek Transect Elevations**

South Lobe Elevations														
Point	Northing	Easting	Design Elevation	Post Construction Elevations	Year 0 Elevations	Year 1 Elevations	Year 2 Elevations	Year 3 Elevations	Year 4 Elevations	Year 5 Elevations	Year 6 Elevations	Year 7 Elevations	Year 8 Elevations	Year 9 Elevations
S-1	705914.01	1181063.36	1.7	1.05	--	1.30	1.23	1.75	1.09	0.25	-0.07	0.31	-0.23	
S-2	705904.40	1181079.00	1.7	0.53	1.42	1.53	1.44	1.17	1.01	1.26	1.50	1.54	1.47	
S-3	705880.46	1181098.72	1.7	0.67	--	1.32	1.23	1.36	1.26	1.28	1.53	1.53	1.42	
S-4	705855.87	1181095.14	1.7	0.73	--	1.39	1.36	1.31	1.39	1.34	1.46	1.47	1.34	
S-5	705826.47	1181088.39	1.8	0.66	--	1.27	1.26	1.30	1.26	1.16	1.29	1.28	1.16	
S-6	705804.98	1181082.76	1.8	0.64	--	0.66	0.71	0.81	0.79	0.68	0.84	0.81	0.63	
S-7	705783.57	1181075.84	1.8	0.61	--	1.22	1.18	1.19	1.18	1.11	1.21	1.21	1.15	
S-8	705763.37	1181064.01	1.9	0.67	--	1.09	1.04	1.05	1.01	0.98	1.07	1.02	0.98	
S-9	705743.90	1181053.00	2.3	0.62	1.41	1.33	1.35	1.34	1.28	1.37	1.42	1.65	1.21	

North Lobe Elevations														
Point	Northing	Easting	Design Elevation	Post Construction Elevations	Year 0 Elevations	Year 1 Elevations	Year 2 Elevations	Year 3 Elevations	Year 4 Elevations	Year 5 Elevations	Year 6 Elevations	Year 7 Elevations	Year 8 Elevations	Year 9 Elevations
N-1	705988.18	1181015.70	1.2	1.48	--	1.44	1.43	1.43	1.30	1.53	1.40	1.47	1.53	
N-2	705999.00	1181026.00	1.5	1.41	1.73	1.61	1.68	1.71	1.47	1.69	1.56	1.62	1.71	
N-3	705987.66	1181055.16	2.1	1.74	--	2.08	2.07	1.88	1.86	1.85	1.74	1.89	1.72	
N-4	705975.21	1181076.61	2.4	1.52	--	1.93	1.91	1.87	1.73	1.76	1.72	1.82	1.77	
N-5	705961.87	1181097.96	2.7	1.92	--	2.00	2.05	2.17	1.95	1.91	1.92	1.99	1.87	
N-6	705949.49	1181119.73	2.7	1.55	--	2.00	1.93	1.51	1.88	1.90	1.81	1.99	1.83	
N-7	705936.30	1181140.86	2.8	1.17	--	1.95	1.90	1.84	1.86	1.84	1.80	1.90	1.81	
N-8	705908.34	1181150.64	3.0	1.40	--	2.06	1.97	1.92	1.93	1.92	1.87	2.05	1.98	
N-9	705869.60	1181162.00	3.5	2.15	2.76	2.64	2.69	2.54	2.50	2.51	2.36	2.66	2.50	

**Table 6-6  
Year 9 Performance Standard Schedule by Site**

<b>Performance Standard</b>	<b>2006 - Year 0</b>	<b>2015 - Year 9</b>	<b>Performance Standard Achieved?</b>
<b>1.0 North Beach Habitat</b>			
<b>Elevation</b>			n/a <sup>1</sup>
1.1.3 Presence of habitat mix at the surface.	B	X	Yes
<b>Riparian Vegetation</b>			n/a <sup>1</sup>
<b>Saltmarsh Vegetation</b>			n/a <sup>1</sup>
<b>Salmonid Presence</b>			n/a <sup>1</sup>
<b>2.0 Middle Waterway Tideflat Habitat</b>			
<b>Elevation</b>			n/a <sup>1</sup>
<b>Riparian Vegetation</b>			n/a <sup>1</sup>
<b>Brackish Marsh Vegetation</b>			n/a <sup>1</sup>
<b>Salmonid Presence</b>			n/a <sup>1</sup>
<b>3.0 Puyallup River Side Channel</b>			
<b>Elevation</b>			n/a <sup>1</sup>
3.1.2 Presence of fine-grained material in interstices of riprap between elevation 13 feet MLLW and 9 feet MLLW.	B	X	Yes
<b>Riparian Vegetation</b>			n/a <sup>1</sup>
<b>Brackish Marsh Vegetation</b>			n/a <sup>1</sup>
<b>Salmonid Presence</b>			n/a <sup>1</sup>

Performance Standard	2006 - Year 0	2015 - Year 9	Performance Standard Achieved?
<b>4.0 Hylebos Creek Mitigation Site</b>			
<b>Elevation</b>			
4.1.1 Average change along centerline transect of channels is less than 0.2 feet from as-built elevation.	B	X	No <sup>2</sup>
4.1.2 No obstruction to fish passage in channels.		X	Yes
<b>Forested Wetland Vegetation</b>			n/a <sup>1</sup>
<b>Emergent Wetland Vegetation</b>			n/a <sup>1</sup>
There is no quantitative performance standard associated with emergent wetland vegetation at this site.			n/a
<b>Salmonid Presence</b>			n/a <sup>1</sup>
<b>Surface Water Elevation</b>			n/a <sup>1,3</sup>

B = Baseline

<sup>1</sup> This monitoring activity was not performed during this monitoring event.

<sup>2</sup> See Sections 6.2.2 and 6.2.3 for additional discussion on compliance with this performance criteria.

<sup>3</sup> Water surface elevation monitoring is performed for informational purposes only.

**Table 6-7  
Year 10 Monitoring Activities**

	North Beach Habitat	Middle Waterway Tideflat Habitat	Puyallup River Side Channel	Hylebos Creek Mitigation Site	Thea Foss Enhancement Areas
Qualitative Ground Survey	x	x	x	x	x
Photo Documentation	x	x	x	x	x
Quantitative Vegetation Monitoring	x	x	x	x	n/a
Invertebrate Monitoring	n/a	n/a	TC	TC	n/a
Elevation Monitoring	x	x	x	x	n/a
Water Surface Elevation Sampling	n/a	n/a	n/a	x	n/a
Brackish Marsh Salinity Monitoring	n/a	TC	n/a	n/a	n/a
Juvenile Salmonid Monitoring	TC	TC	TC	TC	n/a

x      activity required  
 --     activity not required this monitoring year  
 n/a    activity not required at this location  
 TC     task completed





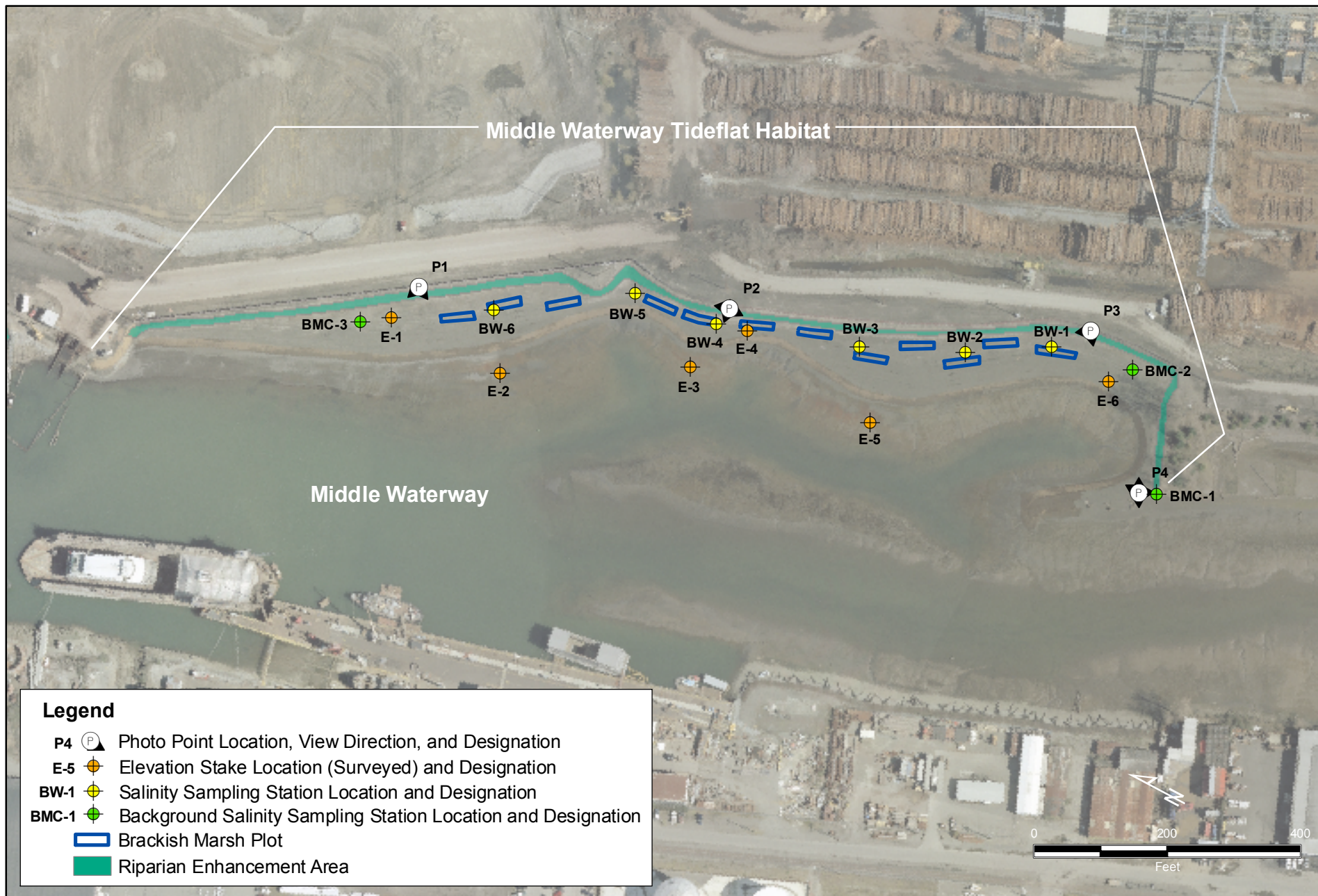
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**Figure 6-1  
North Beach Habitat**





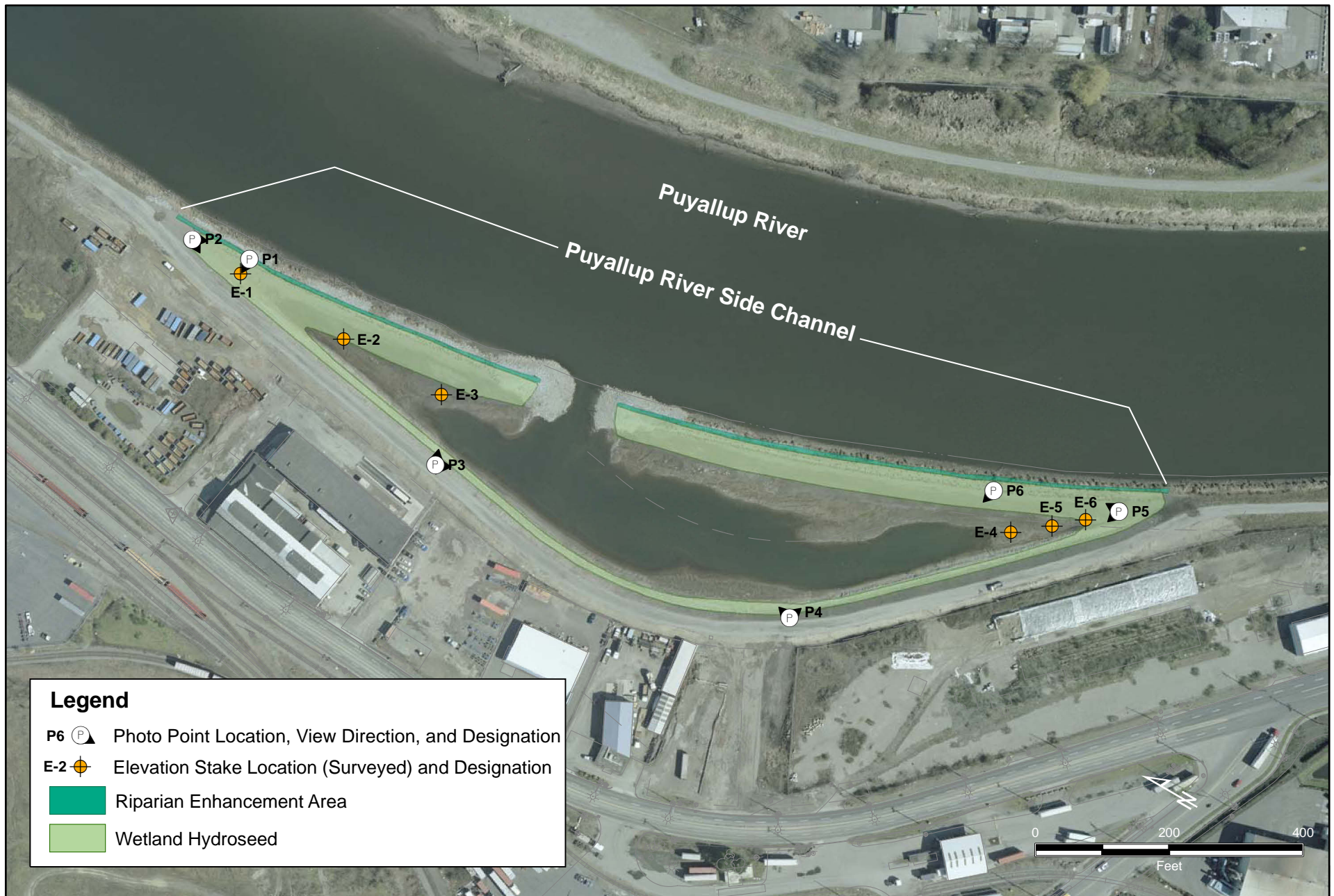
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**Figure 6-2  
Middle Waterway Tideflat Habitat**



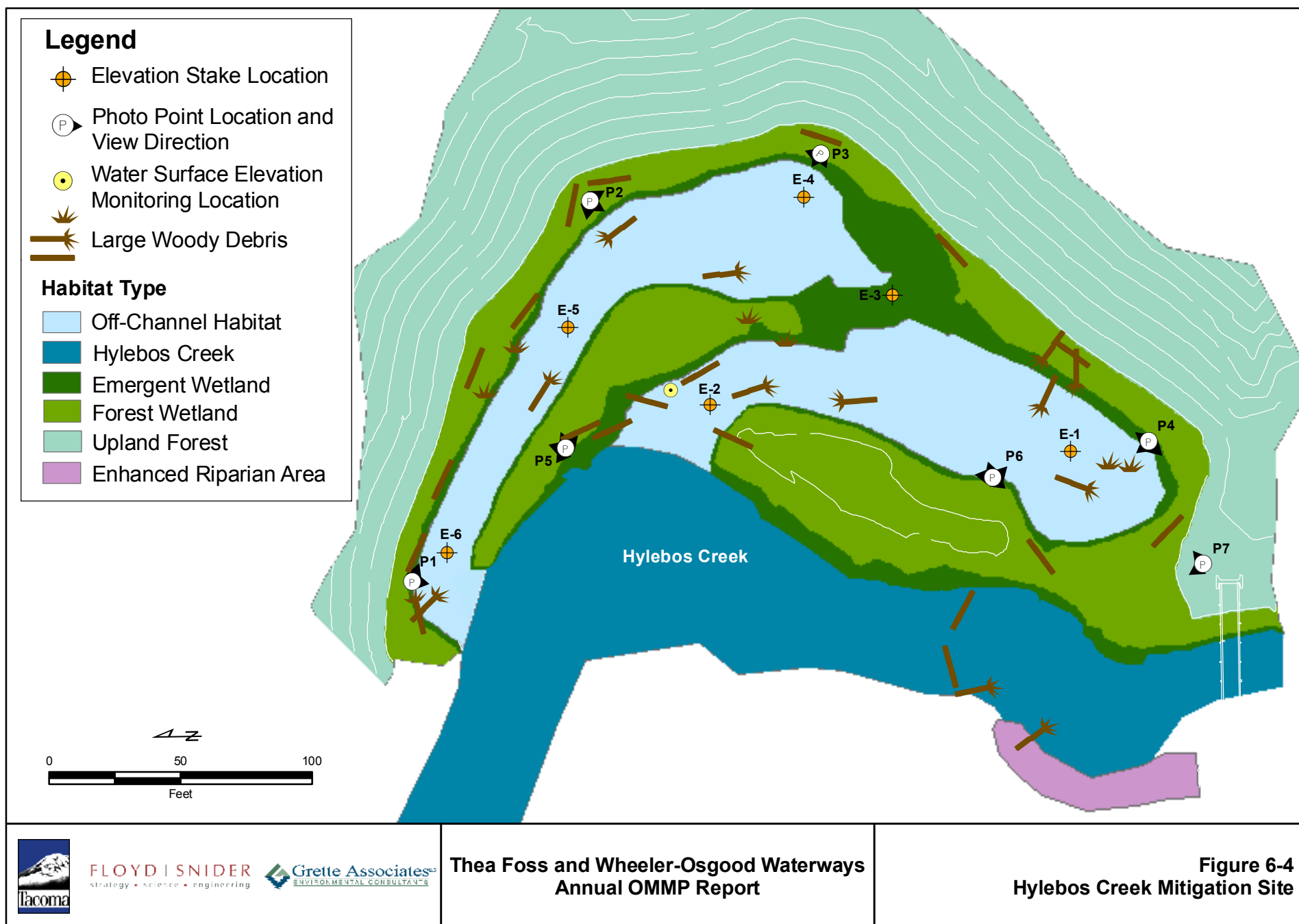


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**Figure 6-3  
Puyallup River Side Channel**

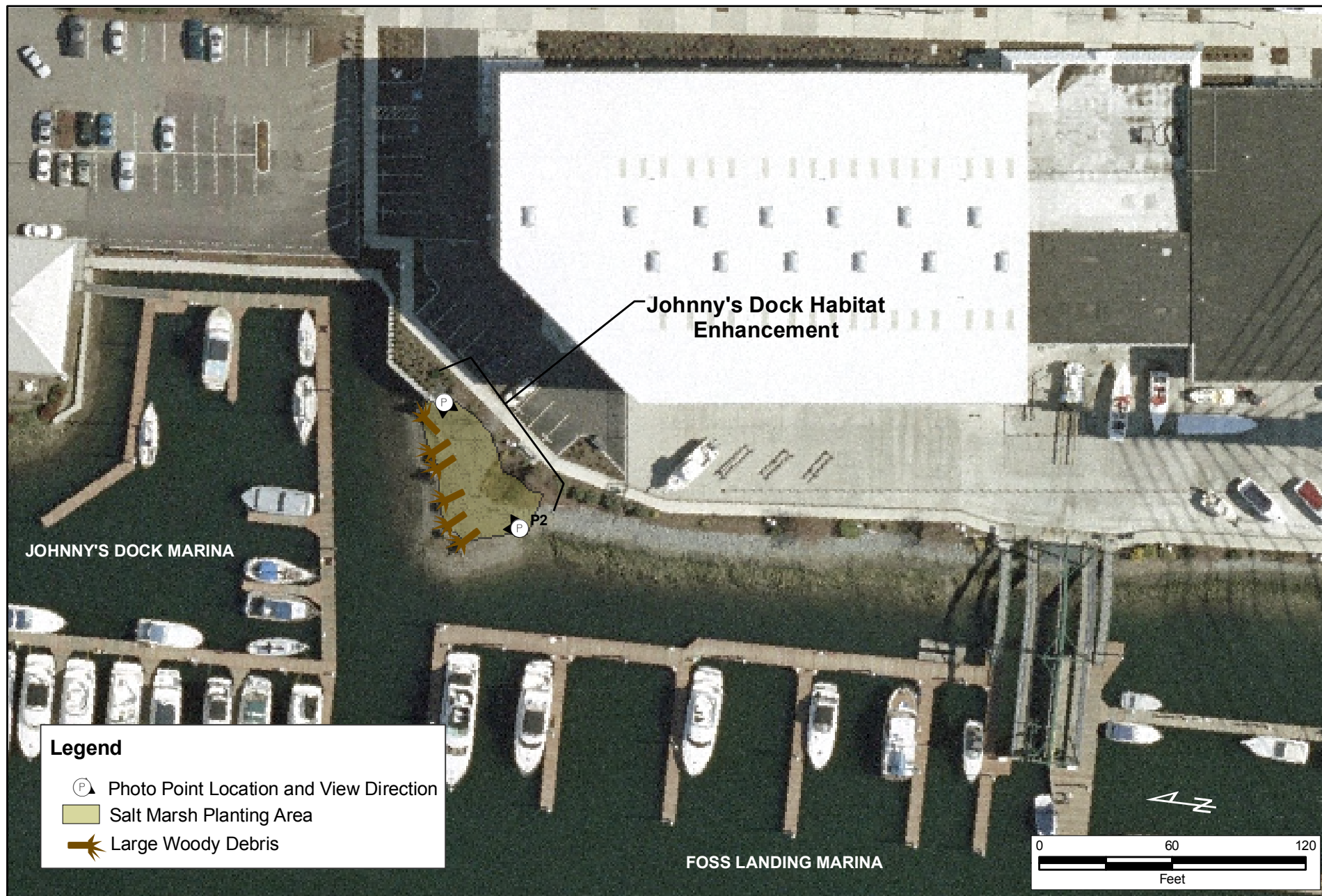


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**Figure 6-4  
Hylebos Creek Mitigation Site**



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**Figure 6-5  
Johnny's Dock Habitat Enhancement**





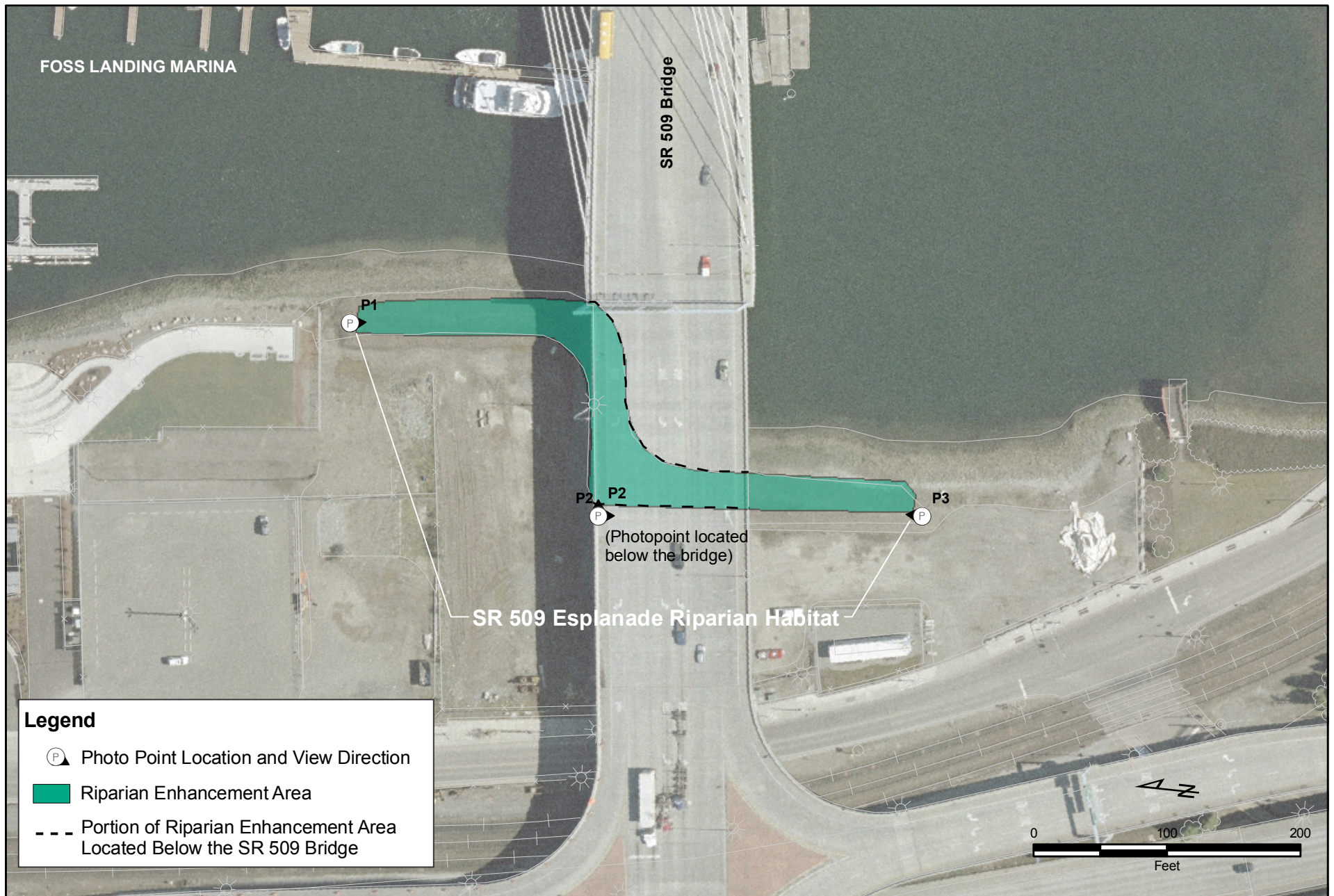
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**Figure 6-6**  
**Head of Thea Foss Shoreline Habitat**





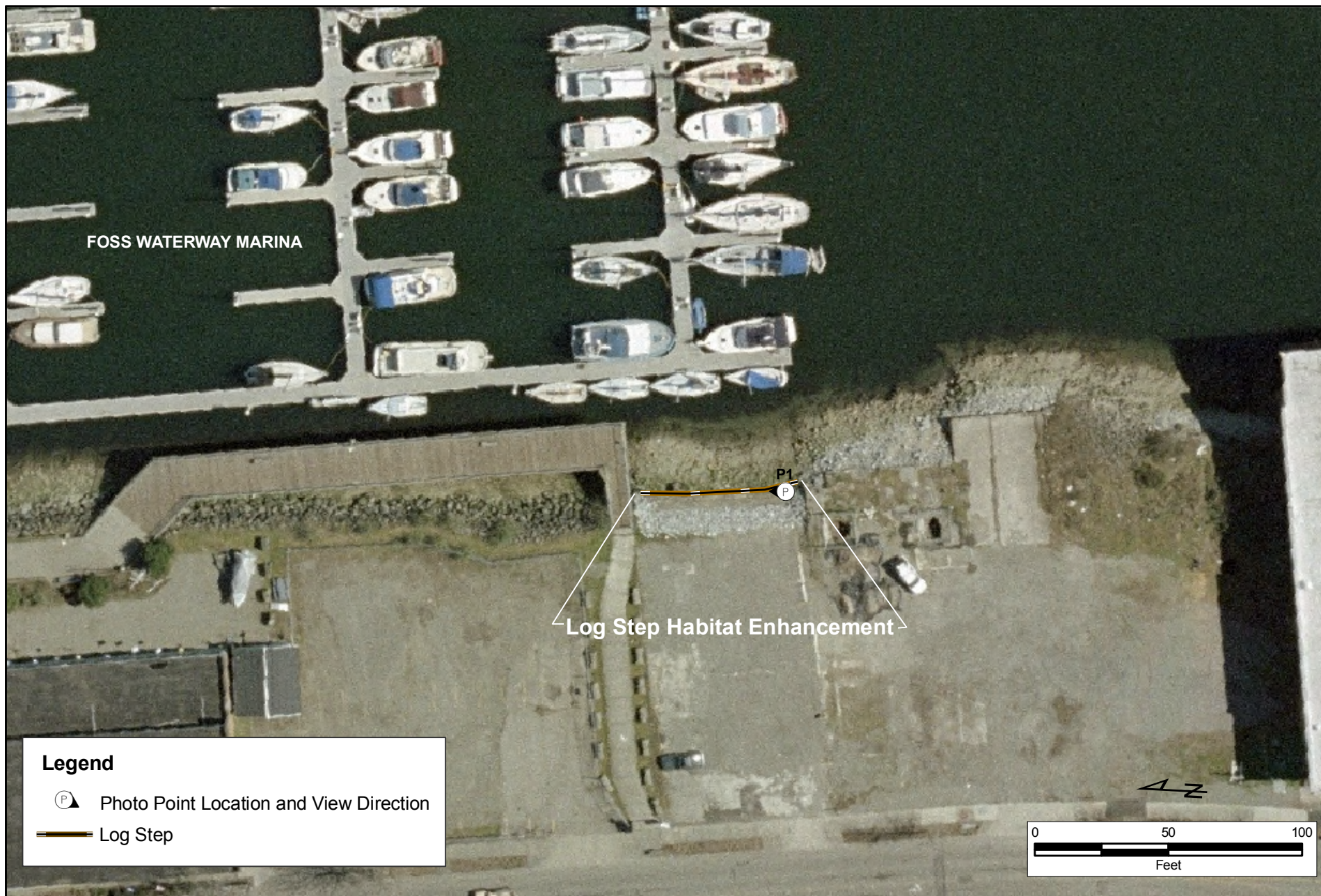
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**Figure 6-7  
SR 509 Esplanade Riparian Habitat**





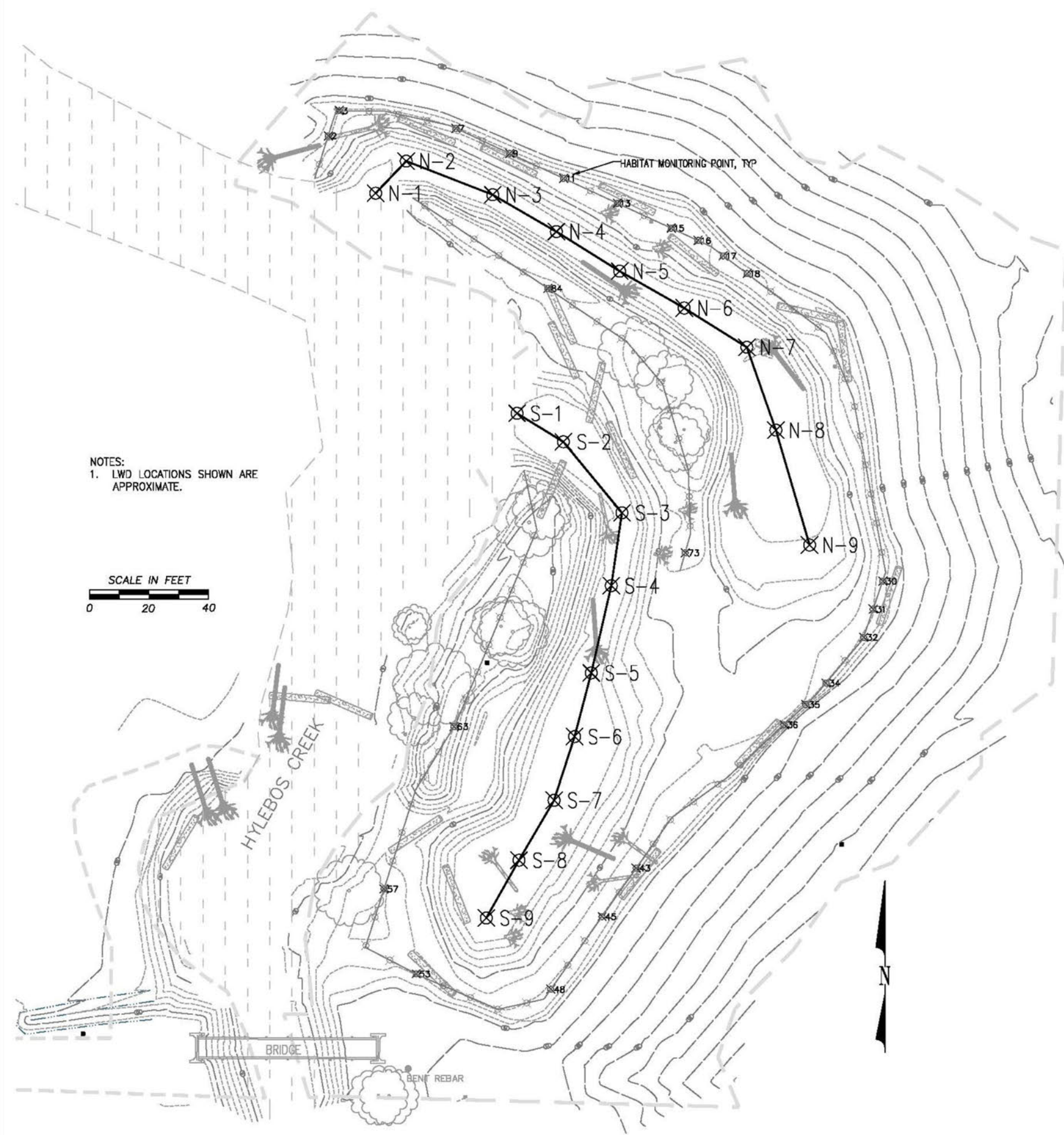
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Figure 6-8  
Log Step Habitat Enhancement





SOUTH LOBE CENTERLINE			
POINT	NORTHING	EASTING	YR 9 ELEV.
S-1	705914.01	1181063.36	0.62
S-2 (E-2)	705904.40	1181079.00	1.63
S-3	705880.46	1181098.72	1.71
S-4	705855.87	1181095.14	1.49
S-5	705826.47	1181088.39	1.32
S-6	705804.98	1181082.76	0.89
S-7	705783.57	1181075.84	1.29
S-8	705763.37	1181064.01	1.20
S-9 (E-1)	705743.90	1181053.00	1.46
NORTH LOBE CENTERLINE			
POINT	NORTHING	EASTING	YR 9 ELEV.
N-1	705988.18	1181015.70	1.59
N-2 (E-6)	705999.00	1181026.00	1.68
N-3	705987.66	1181055.16	1.82
N-4	705975.21	1181076.61	1.87
N-5	705961.87	1181097.96	2.03
N-6	705949.49	1181119.73	2.01
N-7	705936.30	1181140.86	1.97
N-8	705908.34	1181150.64	2.05
N-9 (E-4)	705869.60	1181162.00	2.68

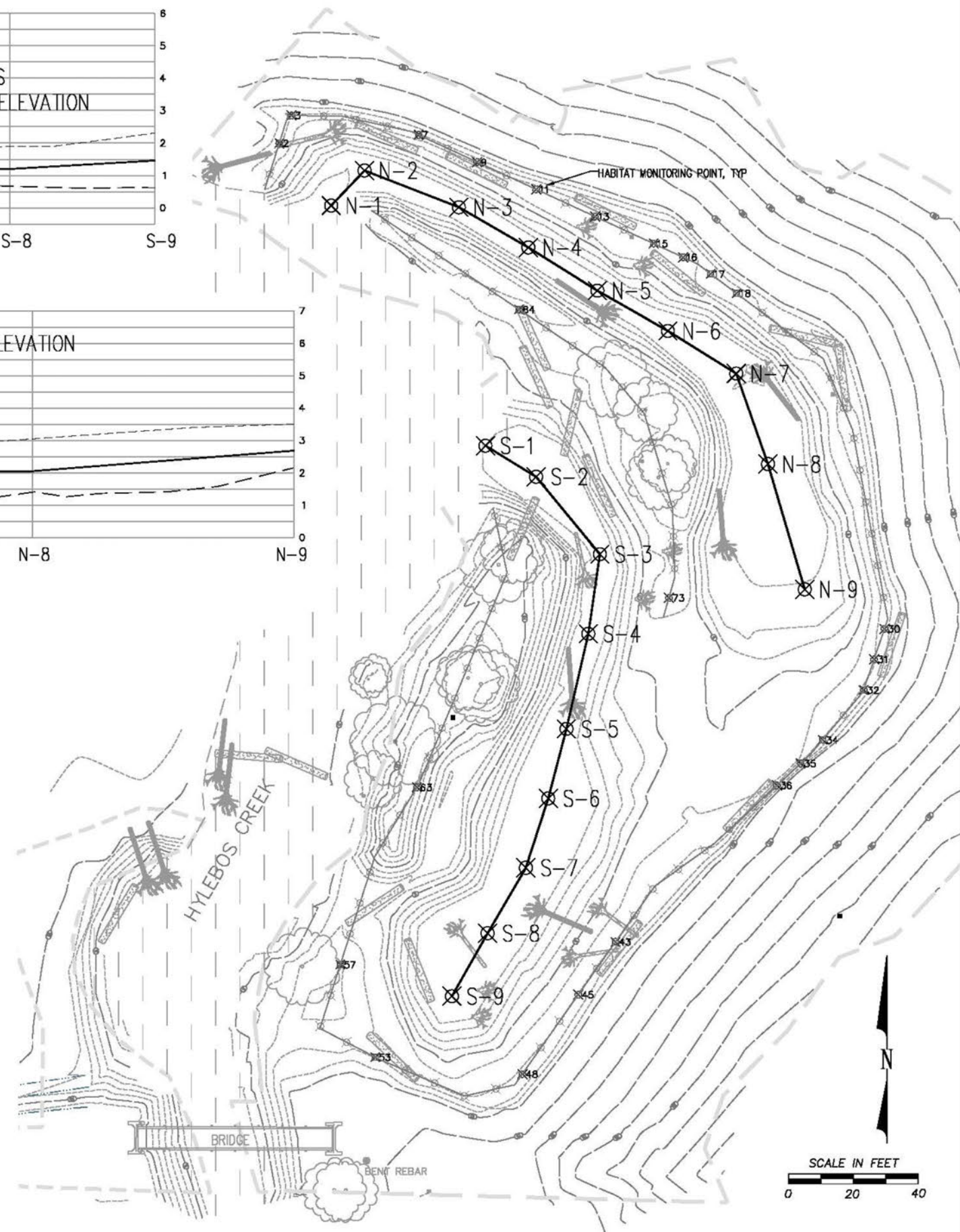
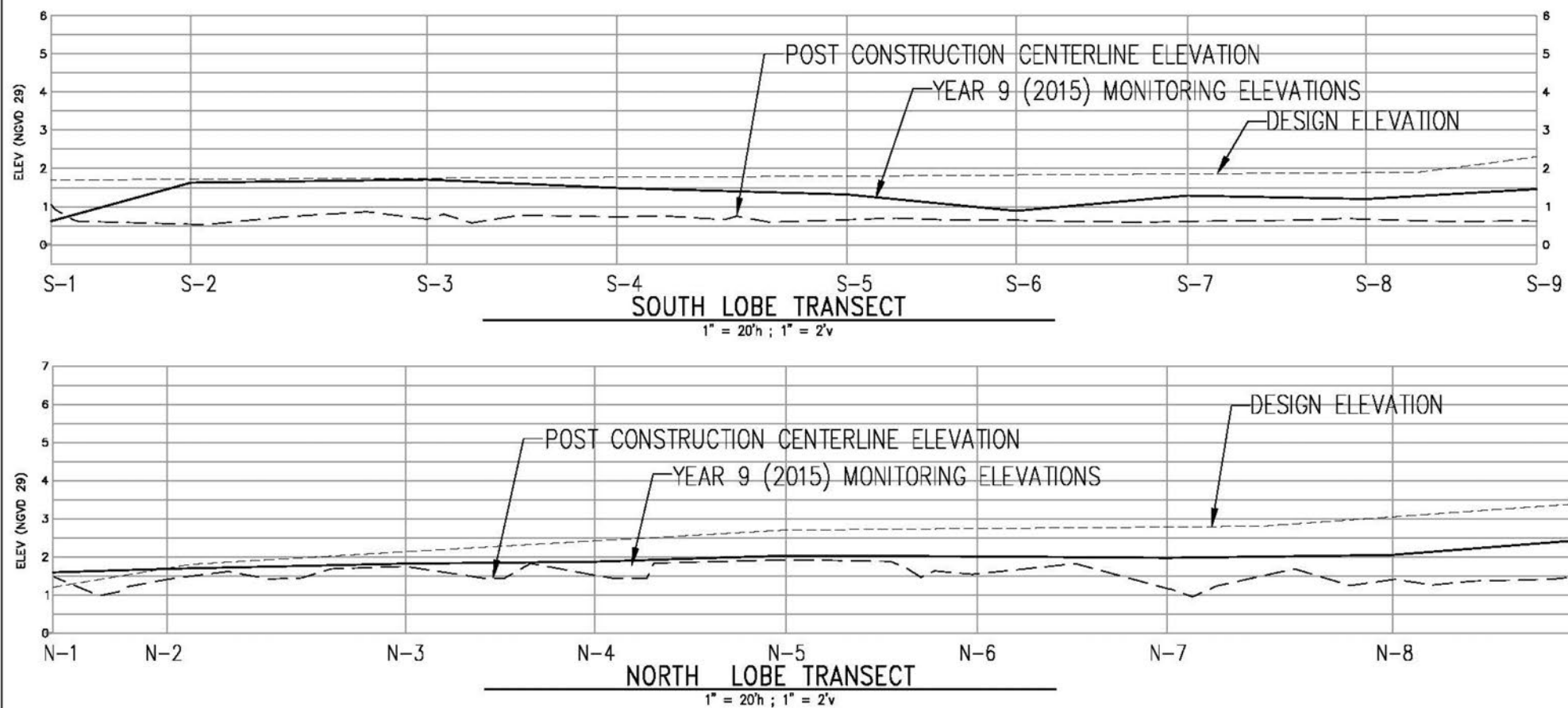


DRAWN BY: TAF/LIH  
DATE: 9/18/2015

THEA FOSS AND WHEELER-OSGOOD WATERWAYS  
OMMP

FIGURE 6.9  
HYLEBOS CREEK HABITAT  
QUANTITATIVE MONITORING LOCATIONS





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 DATE: 9/21/2015

Thea Foss and Wheeler Osgood Waterways  
 OMMP

**Figure 6-10**  
 Hylebos Creek Centerline Transect Elevation Comparison

## 7.0 ADDITIONAL PROJECT RELATED ACTIVITIES

### 7.1 Introduction

Numerous other activities are ongoing during the implementation of the Operations, Maintenance, and Monitoring Plan (OMMP) for the Thea Foss and Wheeler-Osgood Waterways Remediation Project (City of Tacoma 2006) that have some effect on the project. Therefore, status updates on these various activities are provided for informational purposes in this section of the annual reports.

### 7.2 Institutional Controls

In September 2006, the City of Tacoma (City) received the U.S. Environmental Protection Agency's (EPA) approval of an Institutional Controls Plan for the project. The objective of the plan is to ensure that contamination capped in the Thea Foss and Wheeler-Osgood Waterways and in the Confined Disposal Facility within the St. Paul Waterway, and contamination which is otherwise left in place in the Thea Foss and Wheeler-Osgood Waterways (i.e., in natural recovery areas), remains contained and/or undisturbed for the purpose of:

- Reducing the potential exposure of marine organisms to contaminated sediments disposed of and confined in aquatic disposal sites or confined by capping; and
- Reducing the potential exposure of marine organisms to contaminated sediments left in place in the Thea Foss and Wheeler-Osgood Waterways.

Implementation of plan elements which occurred prior to the date of this report has been reported in the applicable Annual Operations, Maintenance, and Monitoring Reports. The following provides a status update on activities related to plan implementation which occurred during Year 9:

- Project representatives continued to work with the City's Planning and Development Services (PDS) division to implement procedures to ensure that future development in and adjacent to the Foss Project areas where remedial actions and habitat mitigation work have been completed, are undertaken in a manner that protects the remedy and the habitat. Project representatives worked with PDS and EPA on a case by case basis to review development proposals as they were submitted. Several development plans are currently under construction or consideration and are being monitored relative to their potential impact on the cleanup areas. These proposals include the following:
  - **Waterway Park** – The Foss Waterway Development Authority (FWDA) is constructing a park development on the east side of the head of the Thea Foss Waterway. Foss Project staff from both the City and the Utilities worked with the FWDA to coordinate upland site cleanup issues and subsequent phases of park development with the existing in-water cleanup and habitat enhancement site elements in that area. Plans for the habitat area were provided to the FWDA for reference. The FWDA received a grant for remediation of the American Plating property landward of the ordinary high water mark, which was required to occur before park development. Remediation was completed in December 2012. Slope stabilization and habitat plantings tying into the existing Foss habitat

enhancement site in this area were subsequently completed as part of the project. A kayak boat launch had previously been constructed in this area.

The FWDA has partnered with the Metropolitan Park District (MPT) on development of the park on this site. Plans are moving forward to initiate schematic design for the park. The MPT and FWDA selected Site Works as the consultant to complete schematic design and public outreach for this next phase of park development. The City will continue to work with the FWDA as the overall park development plan is finalized and construction is completed.

- **Murray Morgan (11th Street) Bridge** – In early 2010, the City took ownership of the Murray Morgan Bridge under a turnback agreement with WSDOT. Rehabilitation and re-opening of the bridge to vehicular traffic was completed in early 2013. As agreed with EPA, sediment samples were taken prior to and at the end of construction to evaluate whether the waterway was impacted by construction activities. An area of sediment recontamination was identified that the bridge contractor was responsible for. The City worked with the contractor and EPA to develop a response plan and the remediation was completed in February 2015. The Draft Remedial Action Construction Report was submitted for agency review on April 24, 2015, and agency comments were received on July 16, 2015. The final report addressing agency comments was submitted on August 11, 2015. A copy of the final report is included in Appendix G as Attachment G-1.
- **Public Esplanade** – The FWDA completed the design of the Site 9 public esplanade (immediately south of the Murray Morgan Bridge on the western shoreline) and has been working to secure funding for permitting. The esplanade at the site will be replaced at a later date when funding becomes available. Reinstallation of the esplanade at Site 9 is funding dependent. Permits are in place but funds have not been identified at this time.

The design and permitting for the esplanade on Site 10 is complete and the City and FWDA are currently working cooperatively to assemble the funding package. The Site 11 Phase II public esplanade located immediately north of the Murray Morgan Bridge has been completed and is open to the public. The public esplanade has been well received and active use of this asset has been immediate.
- **Site 1 at 1933 Dock Street** – Construction is being completed at The Henry and the grand opening is scheduled for October 2015. Improved elements to the park surrounding the site are underway. The park has been named the George H. Weyerhaeuser Jr. Park and will be formally opened in October 2015.
- **Foss Seaport at 705 Dock Street** – The Foss Seaport completed the building shell and the museum has reopened to the public. It has been in active use this summer as a center for marine science and maritime history. Several school districts have learning programs on marine science with the Seaport. Future phases of development will include interior work on HVAC, classrooms and exhibits.
- **Site 4 at 1543 Dock Street** – Business development for this site is underway and the FWDA is anticipating an announcement in 2016 regarding a development timeline for the hotel.

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## Section 7.0 – Additional Project Related Activities

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- **Central Park (1147 Dock Street)** – The FWDA has partnered with the Metropolitan Park District (MPT) on development of Central Park. The MPT and FWDA selected Site Works as the consultant to complete schematic design and public outreach for this next phase of park development in the fall of 2015. Fundraising for the park is anticipated to begin in 2016.
- **Sites 8 & 9 at 1131 & 1119 Dock Street** – In the fall of 2015, these combined sites will be on offering for redevelopment. Uses will be consistent with allowable uses under the S-8 zoning designation of the Tacoma Municipal Code. These sites are being added to the Department of Ecology (Ecology) Area Wide Consent Decree and construction will follow the requirements identified in the Consent Decree. The site specific clean-up action plan is also going to be issued for public comment by Ecology with the Consent Decree Amendment. The FWDA anticipates Ecology will release the documents for public comment in November 2015.
- **Site 10 at 921 Dock Street** – This site is being offered for redevelopment in fall of 2015. Uses will be consistent with allowable uses under the S-8 zoning designation of the Tacoma Municipal Code. This site is not under the Area Wide Consent Decree. The Phase I Environmental Report done on the property did not indicate any historic uses known to generate heavy metals or other common contaminants of concern under the MTCA.
- **Municipal Dock Site at 1025 Dock Street** – This site is being offered for redevelopment in fall of 2015. Uses will be consistent with allowable uses under the S-8 zoning designation of the Tacoma Municipal Code. The site has a No Further Action letter (NFA) from the State Department of Ecology.
- **Simpson Log Haul-Out Pier** – The Simpson sawmill was sold to Canada-based Interfor Corporation on March 1, 2015, and operations at the mill ceased on May 22, 2015. On July 31, 2015, it was announced that the sawmill will not be coming back on line. The company has determined that they will attempt to sell the property. The future use of the property will determine whether the log haul-out will remain in operation. The Foss Project team will continue coordination with of the property owner on any projects in this area as additional information becomes available.
- **Tacoma Metals Site Remediation** – This site is located adjacent to the Puyallup River Side Channel habitat mitigation area. As of the date of this report, Ecology is reviewing a Feasibility Study Addendum. Once that document is finalized, Ecology will complete the Draft Cleanup Action Plan. Ecology representatives anticipate that the Draft CAP will be completed sometime before the end of the calendar year. At that time, a new administrative order will be negotiated to implement the cleanup at the site.

The City will continue to review additional projects and design submittals as they are developed to ensure consistency with, and protection of the remedy.

### **7.3 Stormwater Source Control**

#### **7.3.1 Introduction**

The Thea Foss and Wheeler-Osgood Waterways are located in a highly urbanized drainage basin with residential, commercial and industrial land uses and transportation corridors. Sources of Contaminants of Concern (COCs) continue to exist in the drainage basins and are conveyed to the waterways via stormwater (municipal and private), aerial deposition, marinas, and groundwater seeps. The contaminants identified as having the greatest potential to affect sediment quality following the cleanup action include PAHs and phthalates.

Under a Consent Decree with EPA dated May 9, 2003, the City of Tacoma is implementing a stormwater monitoring and source control strategy for the municipal storm drains entering the Thea Foss and Wheeler-Osgood Waterways to help provide long-term protection of sediment quality in the waterways. The Thea Foss Post-Remediation Source Control Strategy uses a multifaceted approach consisting of aggressive source control efforts, enhanced maintenance, a comprehensive monitoring program, a computer model to predict impacts, and a decision matrix to identify the need for additional source controls. The strategy's elements are integrated with the City's NPDES Phase I requirements, however, many of the elements performed in the Thea Foss basin exceed NPDES requirements.

The City prepared and submitted the Thea Foss and Wheeler-Osgood Waterways 2014 Source Control and Water Year 2014 Stormwater Monitoring Report (Stormwater Annual Report) in March 2015. This Stormwater Annual Report outlines the City's existing programs and studies completed in 2014 and includes a discussion of the need for additional source controls. Included are annual source control evaluations for the seven major outfalls discharging to the waterways; Outfalls 230, 235, 237A, 237B, 243, 245 and 254. The evaluations include a drain by drain assessment and incorporate the review of ongoing studies, source control investigations, water quality data and stormwater suspended particulate matter (SSPM) data for that outfall/basin.

In addition to the 2014 source control evaluations, the Stormwater Annual Report contained a review of the results from the first thirteen years of outfall monitoring conducted under the City's NPDES Program, source control actions completed in the Thea Foss drainage basins and computer model predictions. The history and trends emerging over the thirteen years of the program (2002-2014) are examined and presented in the report.

#### **7.3.2 Stormwater Time Trend Analysis**

Part of the evaluation included in the Stormwater Annual Report is an assessment of whether stormwater quality is improving over time. As described in the report, over a 13 year period (August 2001-September 2014), stormwater and SSPM have been sampled at the seven major outfalls that discharge into the Thea Foss and Wheeler-Osgood Waterways. In addition, baseflow was sampled at the same seven outfalls for the first 10 years of the program. Over the last 13 years, 1,554 samples have been collected with 322 baseflow and 896 stormwater samples collected at the outfalls, and 80 outfall and 256 upline SSPM samples collected in pipeline sediment traps deployed throughout the watershed. This depth of data provides the basis for meaningful statistical evaluation of the trends over the program period.



The number of statistically significant time trends observed in Tacoma's stormwater monitoring record increased to forty-six (46 out of 49 tests, or approximately 94 percent of the tests). All trends were in the direction of decreasing concentrations. This is a larger number of significant reductions than has been observed previously. In Year 12, 44 trends were detected; in Year 11, 41 trends were detected, in Year 10, 37 significant trends were detected; in Year 9, 26 significant trends were observed; in Year 8, 10 significant trends were observed; and in Year 7, only 4 significant trends were observed. It should be noted that some new statistical approaches were implemented beginning in WY2012 and for this reason, the results since then are not fully comparable to previous year's results. However, these changes have improved the statistical approach to the trend analysis, and the City's ability to discern trends.

The time trends were modeled with best-fit regression equations to estimate percent reductions over the 13 year monitoring period for these constituents and outfalls:

- **TSS:** Approximately 41-70% reduction in OF230, OF235, OF237A, OF237B and OF245;
- **Lead:** Approximately 46-74% reduction in OF230, OF235, OF237A, OF237B, OF245 and OF254;
- **Zinc:** Approximately 33-59% reduction in all seven outfalls;
- **PAHs:** Approximately 89-98% reduction in phenanthrene, pyrene and indeno(1,2,3-cd)pyrene in all seven outfalls; and
- **DEHP:** Approximately 69-92% reduction in all seven outfalls.

### 7.3.3 Municipal, State, and Federal Source Control Efforts

The cumulative effect of municipal, state, and federal source control efforts has likely contributed to these observed improvements in stormwater quality. The City has directed numerous source control efforts in this watershed focused on these COCs. The City implements aggressive source control activities that comply with or exceed the requirements of the NPDES permit. Many of these activities have been developed specifically to respond to sources of contaminants found during various investigations.

Stormwater Management Program. The NPDES Phase I Municipal Stormwater Permit (NDPES Phase I Permit), effective August 1, 2013 through July 31, 2018, requires a Stormwater Management Program which is divided into 10 components including stormwater outfall sampling, source control, maintenance, inspections, capital projects, and program development and implementation for the municipal separated storm sewer system (MS4). The City integrates these NPDES program elements with the ongoing Thea Foss Program.

In 2014, City staff performed numerous field activities within the Foss Waterway Watershed including the following:

- Responded to 230 spills/complaints including conducting investigations;
- Provided technical assistance on source control and best management practices;
- Conducted 175 business inspections;
- Assessed an additional 49,442 feet of pipe under the STRAP program.

Information from various source control field activities is entered into a web-based database which is an effective tool for retrieving historical information and examining trends.

Municipal Stormwater Ordinance. The City's stormwater ordinance, through the 2012 Stormwater Management Manual, requires stormwater treatment and control systems on new and redeveloped sites when certain thresholds are met, and provides a mechanism for enforcement of the stormwater management regulations. Through new development and redevelopment, stormwater runoff from industrial and commercial sites throughout the Thea Foss Basin is being converted from untreated to treated runoff (i.e., removal of solids from stormwater runoff).

Special Studies. Tacoma has conducted a number of special studies to better understand the distribution of DEHP and PAHs in the urban environment and how these and other COCs might best be controlled.

Stormwater treatment studies. Stormwater treatment studies have been conducted to evaluate the ability of proprietary and public domain stormwater treatment systems to remove DEHP and PAHs from stormwater runoff. Systems tested to date include StormFilter, AquaFilter, pervious pavements, rain gardens and wet vaults. The City has evaluated each technology's effectiveness, applicability and reasonableness for use within the Foss Waterway Watershed.

Basin-wide sewer line cleaning. Basin-wide sewer line cleaning was conducted in the majority of the area of four drainage basins (OF254 in 2006; OF230 and OF235 in 2007; and OF237B in 2011) and part of a fifth basin (OF237A in 2008). The objective of the sewer line cleaning program is to remove residual sediments in the storm drains and sediment-bound contaminants. Contaminants in sediments present in the system may not solely be from new sources, but may in part be from legacy contamination in the pipe that could be continuing to impact stormwater or baseflow quality through re-suspension and/or dissolution.

A statistical comparison of pre-cleaning versus post-cleaning data ("before" and "after" conditions) shows there are statistically significant reductions in the mean concentrations of all seven Thea Foss index chemicals in OF230, OF235, OF237A, and OF237B and in five of the seven index chemicals in OF254. While this is representative of the results of combined source control efforts, sewer line cleaning appears to have been effective at accelerating removal of PAHs from stormwater, with 63-91% reductions in all five of these drains, including both light and heavy PAH fractions. DEHP also shows a significant reduction of approximately 15-82% in all five drainage basins.

Zinc shows a significant reduction of 13-42% in response to line cleaning in all five of the basins. In 2014, reductions of 10-49% in TSS are statistically significant in four of the five basins (all except OF254), and reductions of 13-50% for lead are statistically significant in four of the five basins (all except OF254). These statistical comparisons will continue to be updated as more post-cleaning data are collected. The statistical power of this test should increase over time, and quite possibly statistical differences that can't be resolved today may be distinguishable in the future.

Enhanced street sweeping program. In January 2007, the City's street sweeping program was enhanced in an attempt to reduce sediment buildup in the storm sewer system. Under the enhanced program, the sweeping frequency was increased, air regenerative sweepers replaced mechanical sweepers, and the City also increased communications with residents, which helped raise awareness of the importance of the street sweeping program.

A statistical comparison of data from before and after implementation of the enhanced sweeping program ("before" and "after" conditions) shows there are statistically significant reductions in the mean concentrations of the three index PAHs and DEHP in all seven outfalls. While this is

representative of the results of combined source control efforts, enhanced street sweeping appears to have been effective at accelerating removal of PAHs and DEHP from stormwater, with 56-80% reductions of PAHs in all seven drains, including both light and heavy PAH fractions. DEHP reductions ranged from approximately 16-73% in the seven drains.

Zinc shows significant reductions of 16-38% in response to enhanced sweeping in all seven basins. In six of the seven basins (all but OF243) lead shows significant reductions of 2-46% and TSS shows significant reductions of 33-49% in four of the seven outfalls (OF230, OF235, OF237B and OF245). A statistically significant increase of 5% was shown in OF237A, however, this may be due in part to the updated data set used for statistical analysis that combined the historical OF237A data with the more recent OF237A New data (Tacoma 2013). These statistical comparisons will continue to be updated as more data are collected. The statistical power of this test should increase over time, and quite possibly statistical differences that can't be resolved today may be distinguishable in the future.

*Stormwater pipe retrofit projects.* In 2010, 13,500 linear feet of existing storm sewer main was structurally rehabilitated in the OF230 drainage basin. In 2013, an additional 13,807 linear feet of existing storm sewer main was structurally rehabilitated in the OF230 drainage basin, along with 5,479 linear feet in the OF235 drainage basin and 5,126 linear feet in the OF237A drainage basin. The rehabilitation projects were accomplished by means of Cured-In-Place Pipe (CIPP) construction technologies using resin impregnated liners which fixed defects (cracks, holes, etc.) in the pipe that could have allowed potentially contaminated groundwater and soil from historic "hot spots" to enter the storm sewer system

A statistical comparison of pre-construction and post-construction monitoring data for the 2010 lining project were reviewed and statistically significant reductions in OF230 were evident for TSS, lead, zinc, PAHs and DEHP (see Table 2-6). CIPP lining, along with other source control activities, resulted in reductions of TSS at 58%, lead at 64%, zinc at 16%, DEHP at 79% and PAHs (phenanthrene, pyrene, and indeno(1,2,3-cd)pyrene) at 87-92%. Since the second lining project was completed in WY2013, there is not enough post-construction monitoring data available at this time to do a pre- and post-construction comparison. This comparison will be performed in future water years once sufficient post-construction data is available.

*GIS-based pollutant loading model.* The City completed development of a GIS-based pollutant loading model to evaluate other stormwater best management practices (BMPs) that may be effective on a basin-wide scale (i.e., affecting tens, hundreds, or thousands of acres). The BMPs under consideration are street sweeping, low-impact development (LID), and engineered treatment devices such as filtration vaults. The goals of this study are: to evaluate the feasibility and cost-effectiveness of stormwater BMPs implemented on a basin-wide scale; to identify areas of concentrated pollutant runoff where source control efforts are best focused; and to assess the degree to which stormwater BMPs will cause a reduction of pollutant loadings, and thereby improvements in Thea Foss sediment quality. The model was calibrated to the City's stormwater monitoring record. The City is currently planning to use this model as a tool in evaluating the selection of stormwater BMPs in the future.

*Other State Regulations.* In July 2012, the Washington State Department of Ecology (Ecology) reissued the final modified Industrial Stormwater General Permit (ISWGP) which includes new requirements. It is anticipated that under Ecology's ISWGP and the existing Construction Stormwater Permit, contaminants in stormwater will be reduced over time from industrial facilities and construction sites. It is also anticipated that reductions of air pollution will occur through Ecology's Air Program. As reductions in air pollution are realized, the pollutant loads washed off upland surfaces and entrained in stormwater runoff will decrease.

### **7.3.4 Compliance with Sediment Quality Objectives in the Waterway**

When the waterway sediment remediation projects were completed, the majority of the sediment surface had no, or very low concentrations of contaminants present since the surface was either dredged to clean sediments or covered with new, clean capping materials. It was anticipated that ongoing source contributions to the waterway would cause concentrations of contaminants to increase gradually. Over time, the goal is to have the contaminant concentrations equilibrate at a level below the sediment cleanup standards set by the EPA. The City developed a predictive model so that actual sediment monitoring results can be compared to model predictions to determine areas where additional source controls may be needed to remain in compliance.

The sediments in the waterway are the true barometer, however, of whether additional source controls are needed for compliance with regulatory requirements. Sediment monitoring was performed by the City in 2013, in the portion of the waterway generally north of the SR 509 Bridge. In addition, in 2014 sediment monitoring was performed by the Utilities, in coordination with the City, in their work area located in the head of the waterway (see Section 7.4 below). An analysis of the Utilities' results in 2014 shows that the data were generally consistent with model predictions and that the risk of significant recontamination is low. In most cases, sediment concentrations have remained relatively stable between their Year 7 and Year 10 monitoring events. Model predictions indicate sediment concentrations begin to level off at approximately Year 7 and are not expected to rise much higher in the future, and generally this is consistent with measured results. Therefore, waterway sediment concentrations appear to have largely equilibrated with modern sources ten years after the completion of the remedial action in the head of the waterway. As a result, the risk of recontamination is not expected to be substantially higher in the future unless there is a change in the nature, strength or distribution of waterway sources.

### **7.3.5 2015 Source Control Work Plan**

A considerable amount of source control work has taken place in the Foss Drainage Basin over the last 13 years. With the significant improvements realized, fewer major source control issues remain. The source control work plan for 2015 identifies specific activities for the watershed and for each basin. Each activity was prioritized in order from highest to lowest with higher priorities given to eliminating/reducing point sources and activities that are based on best professional judgment to provide a measurable benefit in reducing chemical loadings to the waterway. Some highlights planned for 2015 are:

- OF230: Continue source tracing investigation and track private property cleanups in area draining to FD3A and FD18 for mercury and PCBs, with PAHs and phthalates analyzed as well.
- OF237B: Review SSPM results for WY2015 to evaluate the effect of removal of the USTs at the EZ Mart site and determine whether additional investigation is needed.
- OF237B: Track PCB removal activities associated with the road construction project in FD34/35.
- OF243: Continue to investigate source of mercury at Burlington Northern Santa Fe (BNSF) and elsewhere in drainage area for FD23.
- OF245: Continue to coordinate work with TPCHD and Ecology at Truck Rail Handling/Quality Transport to identify any potential source(s) of phthalates.

- All: Review WY2015 SSPM data when available to evaluate the effectiveness of treatment systems installed and source control actions taken.

More information about these activities can be found in the Stormwater Annual Report.

### 7.3.6 Conclusion

Reduction of contaminant loads to the Thea Foss and Wheeler-Osgood Waterways over the years, through the City's implementation of its stormwater source control program, as well as through the control of other sources, has been substantial. The improvement in stormwater quality since the mid-1990s indicates that source control efforts by the City and others in the Foss Waterway Watershed have been effective in reducing chemical concentrations in stormwater. The City believes some minor additional improvements in stormwater quality may be realized in the future with ongoing NPDES Phase I Permit programs and continuing improvements in source control implementation. The City is moving forward with ongoing source tracing investigations, treatability studies, and other special investigations for evaluating and identifying cost-effective controls for metals, DEHP and PAHs in municipal stormwater. Ongoing control of sources which are outside the City's jurisdiction must also continue to be coordinated by other federal, state, and local authorities.

The improvements in stormwater quality since the mid-1990s indicate that source control efforts in the Foss Waterway Watershed have been effective in the reduction of chemical concentrations in stormwater. Tests performed show 94% statistically significant time trends, all in the direction of decreasing concentrations. This result is significant and a testament to the City's ongoing comprehensive source control program. Source control activities currently being implemented by the City include business inspections, response to spills and illicit discharges, mapping/maintenance/cleaning of the stormwater system, pollutant source tracing, and implementation of the City's Surface Water Management Manual through the stormwater ordinance.

It should be noted that while considerable improvements to stormwater quality have been made, the largest changes were realized in the earlier years of the program when major sources were identified and eliminated. Because the source control program has been so effective through the years, fewer major sources or maintenance actions are needed and the program is beginning to approach an equilibrium or maintenance mode. In other words, the concentrations of contaminants of concern in the stormwater in the Foss Waterway Watershed are reaching a level where the opportunities for large reductions are more limited. This may over time lead to the appearance of fewer additional decreasing trends in contaminant concentrations, lower percentages of reduction, and potentially even a few minor increasing trends, particularly if looking only at results from more recent years. However, data shows that the City's stormwater source control and monitoring program have been very effective in reducing contaminant levels in stormwater and SSPM and that the risk of recontamination of sediments over biological effects thresholds in the Thea Foss Waterway from stormwater is low.

### 7.4 Recontamination in the Head of the Thea Foss Waterway

As part of the Utilities' Operations, Maintenance, and Monitoring Plan (OMMP) for the Head of the Thea Foss Waterway (Tetra Tech 2003), sediment sampling and analysis was not required during this reporting period. The most recent compliance monitoring event conducted in the

head of the waterway was the Utilities' Year 10 (2014) OMMP monitoring. The results of this Year 10 monitoring were summarized in the City's Year 8 OMMP Annual Report.

EPA is currently considering the next steps for continued monitoring in the head of the waterway. At this time the agencies have indicated that they plan to coordinate a comprehensive monitoring program for the whole waterway so that the head and the remainder of the waterway are on the same monitoring schedule. It is anticipated that discussions of the next steps in the OMMP monitoring program will be conducted in 2015.

### **7.5 Deauthorization of Navigation Channel in Encroachment Areas**

In accordance with a Memorandum of Agreement between the Army Corps of Engineers (ACOE) and EPA, the City was required to initiate an informal process to deauthorize portions of the federally authorized channel where capping materials encroach on the authorized channel width. The City submitted a request for deauthorization to ACOE on September 25, 2007. A response from ACOE was received on July 9, 2008. The response indicated that, while navigation projects can generally be modified both formally and informally, the informal process would be best for this request. This involved coordination with the congressional delegation to request language be included in the Water Resources Development Act. The ACOE did indicate that they could assist with legislative drafting services for this, if requested by a member of Congress. The City diligently coordinated with its Government Relations Office and the Congressional delegation on the shoreline deauthorization. The City provided the required locational information and legislative language to the Congressional representatives, but inclusion of the language in the bill was delayed because additional information including a cost estimate was required from ACOE. While Congressional representatives were hopeful that they would be able to include the Thea Foss deauthorization language, the final WRDA bill was signed by the President on June 10, 2014, without the Thea Foss deauthorization language included. The Congressional delegation feels very confident that the language will be included in the next WRDA and have indicated that they will make it a top priority.

**Appendix A**

**Physical Cap Integrity Monitoring**

## **Appendix A – Physical Cap Integrity Monitoring**

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This task was not performed during this monitoring event. However, for consistency in reporting, the structure of the OMMP Report and subsequent annual reports will follow the outline of the OMMP. This will provide consistent presentation and placement of information generated during the monitoring of remedial actions performed as part of the Thea Foss and Wheeler-Osgood Waterways Remediation Project. Physical cap integrity monitoring data will be included in the Annual OMMP Report for Monitoring Year 10.



**Appendix B**

**Sediment and Cap Performance Monitoring**

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## **Appendix B – Sediment and Cap Performance Monitoring**

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This task was not performed during this monitoring event. However, for consistency in reporting, the structure of the OMMP Report and subsequent annual reports will follow the outline of the OMMP. This will provide consistent presentation and placement of information generated during the monitoring of remedial actions performed as part of the Thea Foss and Wheeler-Osgood Waterways Remediation Project. Sediment and cap performance monitoring data will be included in the Annual OMMP Report for Monitoring Year 10.

# **Appendix C**

## **Benthic Recolonization Monitoring**

## **Appendix C – Benthic Recolonization Monitoring**

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This task was not performed during this monitoring event. However, for consistency in reporting, the structure of the OMMP Report and subsequent annual reports will follow the outline of the OMMP. This will provide consistent presentation and placement of information generated during the monitoring of remedial actions performed as part of the Thea Foss and Wheeler-Osgood Waterways Remediation Project. Benthic recolonization data will be included in the Annual OMMP Report for Monitoring Year 10.

**Appendix D**

**Confined Disposal Facility Monitoring**

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## **Appendix D– Confined Disposal Facility Monitoring**

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This task was not performed during this monitoring event. However, for consistency in reporting, the structure of the OMMP Report and subsequent annual reports will follow the outline of the OMMP. This will provide for consistent presentation and placement of information generated during the monitoring of remedial actions performed as part of the Thea Foss and Wheeler-Osgood Waterways Remediation Project. CDF performance monitoring data will be included in the Annual OMMP Report for Monitoring Year 10.

**Appendix E**

**Habitat Mitigation Area Monitoring**

**Attachment E-1**

**Habitat Mitigation Area Monitoring  
Field Forms**



# Qualitative Ground Survey, Mitigation Sites

Date: 7.15.15. Time: 9:15am

Year: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Site (circle) North Beach Habitat (NBH) Middle Waterway Tideflat (MWT), Puyallup River Side Channel (PRSC), Hylebos Creek Habitat (HCH)

Staff Present: D. Pooley, M. Carey, S. Holdener, M. Henley

Weather Conditions: Sunny

River Discharge\* (CFS) (PRSC & HCH only): n/a.

Overall health and vigor of plants: Excellent (good) Fair Poor

## Qualitative Observations:

	Riparian Area	Marsh Area	Comments
Erosion			Some of CDF eroding — see pics, fairly stable.
Sedimentation		✓	gravel berm growing.
Wildlife Presence			dead seal, sm. avian species, gull, crow, crab, swallow, seal
Vegetation: Planted			very dry — snowberry, CFC, oceanspray, serviceberry
Volunteer			no new noted in rip. area, fleshy jaumea in SM
Invasive			minor blackberry, St. John's wort, plantain, poison hemlock @
Bark Coverage (%) (MWT only)			n/a
Animal Damage			none noted.
Disease (Vegetation)	✓		minor willow boree.
Human Impacts: Trash	✓		minimal @ high tide
Vandalism			none noted, driving in planted area.
Large Woody Debris (Installed/Recruitment)		✓	yes/yes.
Wrack or Organic Material			none noted.

\* For the Hylebos Creek site, use "Riparian" column for forested wetland and "Marsh" column for emergent wetland. Include additional qualitative notes on high slope upland vegetation below

\*Data from USGS Puyallup River at Puyallup Station (USGS 12101500)

Wildlife Notes (Species observed, other evidence):

see front pg.

Any indication of fish obstruction in the channels? (HCH only) n/a.

Soil/Sediment Quality:	upland	aquatic areas
Odor:	none	none
Sheen:	none	none
Color:	brown	grey / brown
Texture:	topsoil	rock / cobble / sand / silty sand

Presence/condition of habitat mix/fine-grained material at surface - NBH (visual and probe) and PRSC (visual only):

yes - presence no - change from previous yrs.

Elevation Monitoring

not REQ

Monitoring Point	1	2	3	4	5	6
Elevation Relative to Baseline (in)						
Picture Number						

Notes: At MWT, elevation monitoring point 1 was not driven flush initially, so the baseline measurement is at -0.25".

Notes:

- Pickleweed populations in salt marsh area still fluctuating.
- log escapes.
- DNA buoy on site. (2)
- Dune grass planted on front of CDF berm - nicely spaced doing well.
- some erosion near the conveyor belt; going under the belt!
- Pull out rebar on island!!!

Photo Points (Circle Site) (Record Picture # and Time):

Year: 0, 1, 2, 4, 7, 10

Date: 7.15.15

*NOT REQ. REP. Photos taken.*

<b>North Beach</b>	1A – W	1B – NW	2A – E	2B – N
2C – W	3A – E	3B – N	3C – NW	3D – S
4A – S	4B – SW	4C – NW	5A – S	5B – W
5C – N	5D – E	6 – W		
<b>Middle Waterway Tideflat</b>	1A – NW	1B – SW	2A – N	2B – W
2C – S	3A – N	3B – W	4A – S	4B – W
4C – N	4D – E			
<b>Puyallup River Side Channel</b>	1 – W	2A – S	2B – SW	3A – SE
3B – E	4A – NE	4B – SE	5A – N	5B – NE
6 – W				
<b>Hylebos Creek</b>	1A – E	1B – S	2A – SE	2B – SW
2C – W	3A – SW	3B – W	3C – NW	4A – NE
4B – N	4C – NW	5A – S	5B – W	5C – N
5D – E	6A – N	6B – NE	6C – SE	6D – S
7A – NE	7B – N			
<b>Additional Photos</b>				



# Qualitative Ground Survey, Mitigation Sites

Date: 7.15.15

Time: 8:30 am

Year: 0, 1, 2, 3, 4, 5, 6, 7, 8, (9) 10

Site (circle): North Beach Habitat (NBH), Middle Waterway Tideflat (MWT), Puyallup River Side Channel (PRSC), Hylebos Creek Habitat (HCH)

Staff Present: D. Poolen, M. Henley, S. Holdener, M. Carey

Weather Conditions: sunny, hot

River Discharge\* (CFS) (PRSC & HCH only): n/a

Overall health and vigor of plants:

Excellent

Fair

Poor

Qualitative Observations:

	Riparian Area	Marsh Area	Comments
Erosion			> Irrigation break is self-healing - see pics.
Sedimentation			
Wildlife Presence			sand bees.
Vegetation: Planted			good!
Volunteer			no new noted.
Invasive	φ		minimal.
Bark Coverage (%) (MWT only)			5% mostly @ southern end.
Animal Damage			none noted.
Disease (Vegetation)			none noted.
Human Impacts: Trash	φ		assoc w/ encampment.
Vandalism			Perhaps w/ irrigation system.
Large Woody Debris (Installed/Recruitment)		φ	Yes - still missing one on pt / Yes - recruitment / log escapees.
Wrack or Organic Material			Yes @ high tide line.

\* For the Hylebos Creek site, use "Riparian" column for forested wetland and "Marsh" column for emergent wetland. Include additional qualitative notes on high slope upland vegetation below

\*Data from USGS Puyallup River at Puyallup Station (USGS 12101500)

Wildlife Notes (Species observed, other evidence):

sm. avian species, bees.

Any indication of fish obstruction in the channels? (HCH only)

n/a

Soil/Sediment Quality:	upland	aquatic areas
Odor:	none	none.
Sheen:	none	organic
Color:	brown	green / brown algae
Texture:	topsoil, silty sand.	silty sand

Presence/condition of habitat mix/fine-grained material at surface ~~NBH (visual and probe) and PRSC (visual only):~~

n/a

#### Elevation Monitoring

Monitoring Point	1	2	3	4	5	6
Elevation Relative to Baseline (in)				not req.		
Picture Number						

Notes: At MWT, elevation monitoring point 1 was not driven flush initially, so the baseline measurement is at -0.25".

Notes:

Additional fence damage (same area as last year)

transient camp on peninsula b/t mww-Simpson site & mww Tideflat

\* Salt marsh in non-irrigated areas - all salt tolerant species remain  
no brackish species

Irrigation currently non-functioning, Transient living in Pump shed.

Craig Hamburg will look @ next wk.

met Interfor on site - Jon Strong, Steve Doherty.

new owner of property (Simpson sold)

253.341.8202

Photo Points (Circle Site) (Record Picture # and Time):

Date: \_\_\_\_\_

Photos not req. REP photos taken.

Year: 0, 1, 2, 4, 7, 10

<b>North Beach</b>	1A - W	1B - NW	2A - E	2B - N
2C - W	3A - E	3B - N	3C - NW	3D - S
4A - S	4B - SW	4C - NW	5A - S	5B - W
5C - N	5D - E	6 - W		
<b>Middle Waterway Tideflat</b>	1A - NW	1B - SW	2A - N	2B - W
2C - S	3A - N	3B - W	4A - S	4B - W
4C - N	4D - E			
<b>Puyallup River Side Channel</b>	1 - W	2A - S	2B - SW	3A - SE
3B - E	4A - NE	4B - SE	5A - N	5B - NE
6 - W				
<b>Hylebos Creek</b>	1A - E	1B - S	2A - SE	2B - SW
2C - W	3A - SW	3B - W	3C - NW	4A - NE
4B - N	4C - NW	5A - S	5B - W	5C - N
5D - E	6A - N	6B - NE	6C - SE	6D - S
7A - NE	7B - N			
<b>Additional Photos</b>				

# Qualitative Ground Survey, Mitigation Sites

Date: 7.15.15 Time: 3:13 pm

Year: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Site (circle): North Beach Habitat (NBH), Middle Waterway Tideflat (MWT), Puyallup River Side Channel (PRSC), Hylebos Creek Habitat (HCH)

Staff Present: S. Holdener, D. Pooley, M. Carney.

Weather Conditions: sunny

River Discharge\* (CFS) (PRSC & HCH only): 1,590 cfs. (3:15 pm) 10.67' gage height, ft.

Overall health and vigor of plants:

Excellent

Fair

Poor

## Qualitative Observations:

	Riparian Area	Marsh Area	Comments
Erosion			none noted.
Sedimentation		ce	@ upstream end & near breach opening
Wildlife Presence	6	ce	sm. avian species, crow, seagull, geese
Vegetation: Planted			
Volunteer			Rush on east side of proj @ water line
Invasive			wh. swt. clv, no new noted.
Bark Coverage (%) (MWT only)			n/a
Animal Damage			none noted.
Disease (Vegetation)			tent caterpillars / willow bore
Human Impacts: Trash			yes @ upstream end. assoc w/ transient use.
Vandalism			cleared areas for tents / encampments.
Large Woody Debris (Installed/Recruitment)			none / yes - located @ downstream end.
Wrack or Organic Material			yes accumulation @ downstream end.

\* For the Hylebos Creek site, use "Riparian" column for forested wetland and "Marsh" column for emergent wetland. Include additional qualitative notes on high slope upland vegetation below

\*Data from USGS Puyallup River at Puyallup Station (USGS 12101500)



Wildlife Notes (Species observed, other evidence):

See front.

Any indication of fish obstruction in the channels? (HCH only) n/a

Soil/Sediment Quality:	upland	aquatic areas
Odor:	none	none
Sheen:	none	none
Color:	brown	brown w/ algae
Texture:	topsoil, sandy	silty sand.

Presence/condition of habitat mix/fine-grained material at surface - ~~NBH (visual and probe) and PRSC (visual only)~~ n/a present w/ silt layer & algae

#### Elevation Monitoring

Monitoring Point	1	2	3	4	5	6
Elevation Relative to Baseline (in)						
Picture Number						

Notes: At MWT, elevation monitoring point 1 was not driven flush initially, so the baseline measurement is at -0.25".

Notes:

Had eco blks placed to prevent illegal access.  
2 encampments - will contact colon



Photo Points (Circle Site) (Record Picture # and Time):

Date: \_\_\_\_\_

*NOT REQ. REP Photos taken.*

Year: 0, 1, 2, 4, 7, 10

<b>North Beach</b>	1A – W	1B – NW	2A – E	2B – N
2C – W	3A – E	3B – N	3C – NW	3D – S
4A – S	4B – SW	4C – NW	5A – S	5B – W
5C – N	5D – E	6 – W		
<b>Middle Waterway Tideflat</b>	1A – NW	1B – SW	2A – N	2B – W
2C – S	3A – N	3B – W	4A – S	4B – W
4C – N	4D – E			
<b>Puyallup River Side Channel</b>	1 – W	2A – S	2B – SW	3A – SE
3B – E	4A – NE	4B – SE	5A – N	5B – NE
6 – W				
<b>Hylebos Creek</b>	1A – E	1B – S	2A – SE	2B – SW
2C – W	3A – SW	3B – W	3C – NW	4A – NE
4B – N	4C – NW	5A – S	5B – W	5C – N
5D – E	6A – N	6B – NE	6C – SE	6D – S
7A – NE	7B – N			
<b>Additional Photos</b>				

# Qualitative Ground Survey, Mitigation Sites

Date: 7.15.15 Time: 2pm

Year: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Site (circle): North Beach Habitat (NBH), Middle Waterway Tideflat (MWT), Puyallup River Side Channel (PRSC), Hylebos Creek Habitat (HCH)

Staff Present: D. Pooley, S. Holdener, M. Carey

Weather Conditions: Sunny

River Discharge\* (CFS) (PRSC & HCH only): 1,630 cfs (2pm) 10.72 gage height, ft.

Overall health and vigor of plants: Excellent Fair Poor

## Qualitative Observations:

	Riparian Area	Marsh Area	Comments
Erosion			none noted
Sedimentation			none noted.
Wildlife Presence	<u>✓</u> <u>✓</u>		beaver, sm. avian species, jellyfish
Vegetation: Planted			continued planting up on top of hill.
Volunteer			no new noted
Invasive	<u>✓</u>	<u>✓</u>	peppercweed, purple loosestrife, knotweed. <u>RCC</u> <u>teasel</u> <u>yellow</u> <u>flag iris</u>
Bark Coverage (%) (MWT only)			n/a.
Animal Damage	<u>✓</u>		beaver, no recent
Disease (Vegetation)		<u>✓</u>	wilts have crinkly new growth in marsh area
Human Impacts: Trash	<u>✓</u>		minor
Vandalism			none noted.
Large Woody Debris (Installed/Recruitment)		<u>✓</u>	present, minor recruitment.
Wrack or Organic Material			no significant accumulation.

\* For the Hylebos Creek site, use "Riparian" column for forested wetland and "Marsh" column for emergent wetland. Include additional qualitative notes on high slope upland vegetation below

\*Data from USGS Puyallup River at Puyallup Station (USGS 12101500)

Wildlife Notes (Species observed, other evidence):

sm anian species, bees,

Any indication of fish obstruction in the channels? (HCH only) no fish obstructions.

Soil/Sediment Quality:	upland	aquatic areas
Odor:	none	none
Sheen:	none	none
Color:	brown	brown
Texture:	topsoil	silty sand.

Presence/condition of habitat mix/fine-grained material at surface - NBH (visual and probe) and PRSC (visual only):

n/a

Elevation Monitoring

Monitoring Point	1	2	3	4	5	6
Elevation Relative to Baseline (in)						
Picture Number						

Notes: At MWT, elevation monitoring point 1 was not driven flush initially, so the baseline measurement is at -0.25".

Notes:

Removal of blackberry needed - beat back from planting area on north side.

Photo Points (Circle Site) (Record Picture # and Time):

NOT REQ. DEP photos taken.  
Year: 0, 1, 2, 4, 7, 10

Date: \_\_\_\_\_

<b>North Beach</b>	1A – W	1B – NW	2A – E	2B – N
2C – W	3A – E	3B – N	3C – NW	3D – S
4A – S	4B – SW	4C – NW	5A – S	5B – W
5C – N	5D – E	6 – W		
<b>Middle Waterway Tideflat</b>	1A – NW	1B – SW	2A – N	2B – W
2C – S	3A – N	3B – W	4A – S	4B – W
4C – N	4D – E			
<b>Puyallup River Side Channel</b>	1 – W	2A – S	2B – SW	3A – SE
3B – E	4A – NE	4B – SE	5A – N	5B – NE
6 – W				
<b>Hylebos Creek</b>	1A – E	1B – S	2A – SE	2B – SW
2C – W	3A – SW	3B – W	3C – NW	4A – NE
4B – N	4C – NW	5A – S	5B – W	5C – N
5D – E	6A – N	6B – NE	6C – SE	6D – S
7A – NE	7B – N			
<b>Additional Photos</b>				

# Qualitative Ground Survey, Thea Foss Enhancement Sites

Date: 7.14.15 Time: 10:24 am

Year: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Site (circle): Johnny's Dock (JDH), Head of Thea Foss (HTF), SR509 Esplanade (509), Log Step Habitat (LSH)

Staff Present: D. Pooley, S. Holdener

Weather Conditions: Sunny

Overall health and vigor of plants: Excellent Fair Poor

## Qualitative Observations:

	Riparian Area	Marsh Area	Comments
Erosion		0	minor, some sloughing of gravels
Sedimentation			none noted
Wildlife	0	0	geese, bees,
Vegetation			
Invasive			none noted.
Volunteer	0		lots of gumweed! <del>salt grass</del>
Animal Damage			none none, exception mid-site either weed wacker or geese
Disease			none noted
Trash			none noted
Vandalism			none noted.
Large Woody Debris	0		present
Wrack or Organic Material			none noted.

predation on salt grass & few stems of dune grass.

Wildlife Notes (species observed, other evidence):

see front.

Soil/Sediment Quality:	upland	aquatic areas
Odor:		none
Sheen:		none
Color:		grey
Texture:		gravelly sand

Notes:

Photo Points (Circle Site):

not req. REP photos taken.

Year: 0, 1, 2, 4, 7, 10

Johnny's Dock	1A - SW	1B - NW	2A - NW	2B - NE
Head of Thea Foss	1 - S	2 - N		
SR509 Esplanade	1 - S	2A - E	2B - S	3 - N
Log Step	1 - N			
Additional Photos				



Vegetation Diversity Notes:

RIPARIAN

Planted Species

Volunteer Species

Invasive Species

MARSH

Planted Species sm. dune grass, salt grass

Volunteer Species gumweed, few potentilla

Invasive Species none noted.

MISCELLANEOUS ADDITIONAL NOTES:

no pickleweed, no tufted hairgrass

tighten cables on mid LWD

# Qualitative Ground Survey, Thea Foss Enhancement Sites

Date: 7.14.15 Time: 9:46 am

Year: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Site (circle): Johnny's Dock (JDH) Head of Thea Foss (HTF), SR509 Esplanade (509), Log Step Habitat (LSH)

Staff Present: D. Pooley, S. Holdener

Weather Conditions: Sunny

Overall health and vigor of plants: Excellent Fair Poor

## Qualitative Observations:

	Riparian Area	Marsh Area	Comments
Erosion			none noted.
Sedimentation			none noted.
Wildlife	✓	✓	grasshopper, bees, sm. arian species, geese, gulls, ducks, <sup>pigeon</sup> crow
Vegetation			dry
Invasive	✓ ✓		<u>peppercweed</u> , <u>knopweed</u> , wh. swt. clover dock, tansy, <sup>poison</sup> hemlock
Volunteer		✓	sunweed, phragmites.
Animal Damage			none noted.
Disease	✓		none noted, exception willow borek.
Trash	✓		@ So. end - lots of cans/bottles,
Vandalism			none noted.
Large Woody Debris		✓	present.
Wrack or Organic Material			none noted.



Wildlife Notes (species observed, other evidence):

See front sheet.

Soil/Sediment Quality:	upland	aquatic areas
Odor:	none	none
Sheen:	none	none
Color:	brown	grey
Texture:	silty/sand topsoil	rip rap / fish mix

Notes:

- most plants in newly planted southern area doing well.
- needed massive removal.
- Pepperweed.
- some rose from remediation planting took
- no willow at no. end

Photo Points (Circle Site): not Req. REP. Photos taken

Year: 0, 1, 2, 4, 7, 10

Johnny's Dock	1A - SW	1B - NW	2A - NW	2B - NE
Head of Thea Foss	1 - S	2 - N		
SR509 Esplanade	1 - S	2A - E	2B - S	3 - N
Log Step	1 - N			
Additional Photos				

Vegetation Diversity Notes:

RIPARIAN

Planted Species potentilla, willow, tufted hairgrass, rose,

Volunteer Species cottonwood, beech rose.

Invasive Species St. John's wort, reppeweed, blkberry, tansy, wh. swt clover, knotweed.  
night shade, poison hemlock

MARSH

Planted Species

Volunteer Species gumweed.

Invasive Species phragmites - flagged.

MISCELLANEOUS ADDITIONAL NOTES:

willow has boxer killing limbs. / much stem/trunk damage

# Qualitative Ground Survey, Thea Foss Enhancement Sites

Date: 7.14.15 Time: 9 am

Year: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Site (circle): Johnny's Dock (JDH), Head of Thea Foss (HTF) SR509 Esplanade (509) Log Step Habitat (LSH)

Staff Present: D. Pooley, S. Holdener

Weather Conditions: Sunny, breezy

Overall health and vigor of plants: Excellent good Fair Poor

## Qualitative Observations:

	Riparian Area	Marsh Area	Comments
Erosion		<u>✓</u>	<u>@ trail <sup>back</sup> edges uncovering lots of concrete debris. (See pics)</u>
Sedimentation			<u>none noted.</u>
Wildlife	<u>✓</u>	<u>✓</u>	<u>sm. avian species, dead rat, snake, sculpin, dog</u>
Vegetation	<u>✓</u>		<u>very dry</u>
Invasive	<u>✓</u>	<u>✓</u>	<u>pepperweed, poison hemlock, blackberry, dock.</u>
Volunteer		<u>✓</u>	<u>fleshy jaumea, orache, gumweed.</u>
Animal Damage			<u>none noted.</u>
Disease			<u>none noted.</u>
Trash	<u>✓</u>		<u>minor assoc. w/ human transient activity.</u>
Vandalism		<u>✓</u>	<u>none noted, path still present &amp; maintained.</u>
Large Woody Debris			<u>not present.</u>
Wrack or Organic Material			<u>none noted.</u>

Wildlife Notes (species observed, other evidence):

Snake, Sm. Avian species, dead rat, geese in water

Sculpin noted in shallow water near outfall;  
feeding behaviors.

Soil/Sediment Quality:	upland	aquatic areas
Odor:	none	none
Sheen:	none	none
Color:	brown	brown/green kelp
Texture:	topsoil/sandy	coarse sand/riprap

Notes:

very dry

Photo Points (Circle Site):

not req. REP. photos taken.

Year: 0, 1, 2, 4, 7, 10

Johnny's Dock	1A - SW	1B - NW	2A - NW	2B - NE
Head of Thea Foss	1 - S	2 - N		
SR509 Esplanade	1 - S	2A - E	2B - S	3 - N
Log Step	1 - N			
Additional Photos				



Vegetation Diversity Notes:

~~RIPARIAN~~ MARSH

Planted Species

Volunteer Species gumweed, pickleweed, orache, goosefoot

Invasive Species

~~MARSH~~ RIPARIAN.

Planted Species

red flowering currant, or. grape, shore pine, oceanspray  
coastal strawberry

Volunteer Species

gumweed, cottonwood,

Invasive Species

Pepperweed, dock, borage blackberry, mustard (under bridge area)

MISCELLANEOUS ADDITIONAL NOTES:

Weed eat. around plants, take down dead tree and RFC (dead)

# Qualitative Ground Survey, Thea Foss Enhancement Sites

Date: 7.14.15 Time: 8:31 am

Year: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Site (circle): Johnny's Dock (JDH), Head of Thea Foss (HTF), SR509 Esplanade (509), Log Step Habitat (LSH)

Staff Present: D. Pooley, S. Holdener

Weather Conditions: Sunny, light breeze.

Overall health and vigor of plants: Excellent [Good] Fair Poor

## Qualitative Observations:

	Riparian Area	Marsh Area	Comments
Erosion	✓		minor behind logs.
Sedimentation			none noted.
Wildlife			caspian tern, gull (heard) nearby
Vegetation			dry
Invasive			none noted, adjacent site cleared.
Volunteer		✓	pickleweed, gumweed, orache, goosefoot
Animal Damage			none noted
Disease			none noted
Trash	✓		minor floatables
Vandalism			none noted.
Large Woody Debris		✓	present
Wrack or Organic Material	✓		minor @ high tide line

Wildlife Notes (species observed, other evidence):

gull calls, caspian terns - calls

Soil/Sediment Quality:	upland	aquatic areas
Odor:	none	none
Sheen:	none	none
Color:	grey silt/clay	green/brown algae
Texture:	large coarse sand	coarse sand to cobble

Notes:

adjacent prop & upland parking area normally filled w/ invasives  
has been recently cleared and maintained.

tighten cables?

Photo Points (Circle Site):

no pics req. Rep. photos taken.

Year: 0, 1, 2, 4, 7, 10

Johnny's Dock	1A - SW	1B - NW	2A - NW	2B - NE
Head of Thea Foss	1 - S	2 - N		
SR509 Esplanade	1 - S	2A - E	2B - S	3 - N
Log Step	1 - N			
Additional Photos				

Vegetation Diversity Notes:

RIPARIAN

Planted Species none

Volunteer Species random grass, sp.

Invasive Species one blackberry in riprap.

MARSH

Planted Species dune grass, - thinner than normal (maybe because of heat?)  
no tufted hair grass.

Volunteer Species pickleweed, gumweed, orache,  
Pickleweed spreading down the shoreline.

Invasive Species none noted.

MISCELLANEOUS ADDITIONAL NOTES:



**Attachment E-2**

**Habitat Mitigation Area Monitoring  
Miscellaneous Photographs**



MWTF Erosioanl Area by Log Haulout July 2015



MWTF Erosioanl Area by Log Haulout July 2015



MWTF Erosioanl Area by Log Haulout July 2015



2013 MWTF Irrigation Break Area



2013 MWTF Irrigation Break Area





MWTF Irrigation Break Area July 2015



MWTF Irrigation Break Area July 2015



MWTF Irrigation Break Area July 2015



MWTF Irrigation Break Area July 2015

## **Attachment E-3**

### **Habitat Mitigation Area Monitoring Hylebos Survey Information**

## Hylebos Creek Forest Wetlands

Love +  
Greenawalt

69.

9/9/15

Pont #	HCHW #	7/25/14 Elev	9/4/15 Elev
1050	2	8.42	8.15
1049	3	8.14	8.21
1048	7	7.75	7.63
1046	9	7.29	7.55
1047	11	7.06	6.66
1045	13	6.59	6.81
1044	15	6.44	6.54
1043	16	6.63	6.66
1042	17	6.95	7.10
1041	18	7.45	7.57
1030	25	7.83	7.96
1029	30	7.96	8.08
1028	31	7.10	7.33
1012	32	7.41	7.73
1013	34	7.00	7.09
1090	35	7.20	7.34
1091	36	6.84	6.75
1092	43	7.15	7.25
1093	45	7.03	7.12
1094	48	7.31	7.59
1095	53	8.41	8.57
1096	57	7.46	7.87
1097	63	11.94	12.27

3711



Hylabos Creble

## Forest wetlands

Point #	HCW #	7/25/14 Elev	9/9/15 Elev
1088	73	6.18	6.39
1099	84	6.6	6.67
1089	Transect End	6.36	6.50
1098	Transect End	6.66	6.72
1100	Transect End	6.94	6.87
1027	Transect End	5.73	Missing

Lovett  
Greenawalt

70

3711

9/11/15

# Hylebos Creek

Sediment Pipes See Pg 2

Pont#	Pipe#	Bent Completely Gone To Foot	Flev. Dist to Top Pipe
1078	E1-S9		UNUSUAL
1066	E-2		1.98 0.20
1067	E-3		5.50 0.90
1068	E-4-N9		2.68 1.15
1073	E-5		2.00 1.00
1077	E-6-N2		1.68 1.00

North Channel

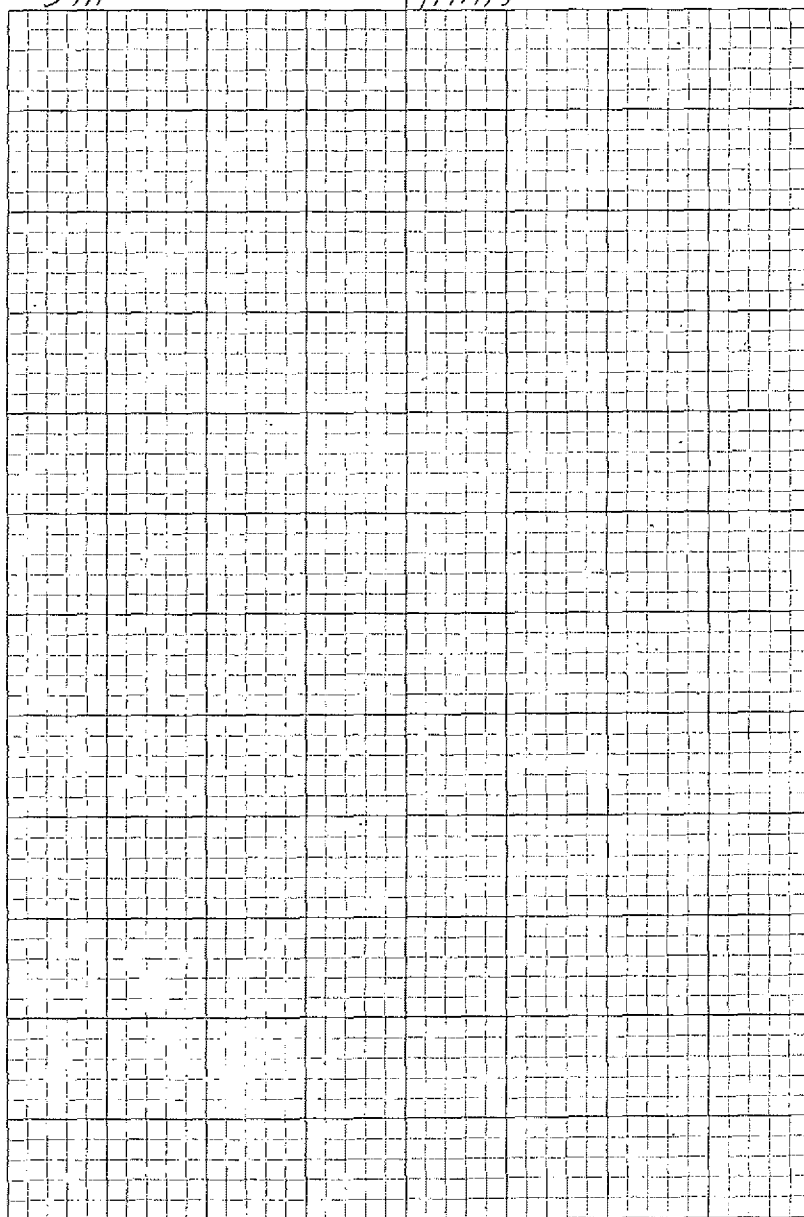
1087	N-1	1.59	1.57
1077	N-2	1.68	
1076	N-3	1.82	
1075	N-4	1.87	
1074	N-5	2.03	
1072	N-6	2.01	
1070	N-7	1.97	
1069	N-8	3.05	
1068	N-9	2.68	

LOV #  
Greenawald

71

911115

3711



Nyctebos, Creek

South Channel

Lovett  
Greenwald

72

3711

9/11/15

P.O. nt #		Elev
1101	S-1	0.62
1085	S-2	1.63
1084	S-3	1.71
1083	S-4	1.49
1082	S-5	1.32
1081	S-6	0.89
1080	S-7	1.29
1079	S-8	1.20
1078	S-9	1.46

# **Appendix F**

## **Health and Safety Plan**

For consistency in reporting, the structure of the annual reports follow the outline of the OMMP. This provides consistent presentation and placement of information generated during the monitoring of remedial actions performed as part of the Thea Foss and Wheeler-Osgood Waterways Remediation Project. Only minor modifications to the Health and Safety Plan have been made during this reporting period. These include:

- Updating the Field Health and Safety officer on pages F-1 and F-3 from Chris Getchell to Stuart Magoon. The reported phone number remains the same.

## **Appendix G**

### **Additional Project Related Activities**



**Attachment G-1**

**Murray Morgan Bridge Final Report**

# Murray Morgan Bridge Remedial Action

## Remedial Action Construction Report



### Prepared for

City of Tacoma  
747 Market Street  
Tacoma, WA 98402

**August 2015**

#### **LIMITATIONS**

This report has been prepared for the exclusive use of the City of Tacoma, their authorized agents, and regulatory agencies. It has been prepared following the described methods and information available at the time of the work. No other party should use this report for any purpose other than that originally intended, unless Floyd|Snider agrees in advance to such reliance in writing. The information contained herein should not be utilized for any purpose or project except the one originally intended. Under no circumstances shall this document be altered, updated, or revised without written authorization of Floyd|Snider.

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### List of Acronyms and Abbreviations

Acronym/ Abbreviation	Definition
American	American Construction Company
CD	Consent Decree
City	City of Tacoma
cm	Centimeters
CY	Cubic yards
DGPS	Digital Global Positioning System
DO	Dissolved oxygen
FEI	Field Environmental Instruments Inc.



<b>Acronym/ Abbreviation</b>	<b>Definition</b>
gpm	Gallons per minute
GPS	Global Positioning System
LCS	Laboratory control sample
LCSD	Laboratory control sample duplicate
mg/kg	Milligrams per kilogram
MLLW	Mean lower low water
MMB	Murray Morgan Bridge
MS/MSD	Matrix spike
MSD	Matrix spike duplicate
NOAA	National Oceanic and Atmospheric Administration
NTU	Nephelometric Turbidity Unit
OMMP	Operations, Maintenance, and Monitoring Plan
PCL	PCL Civil Contractors, Inc.
RACR	Remedial Action Construction Report
RAWP	Remedial Action Work Plan
Republic	Republic Services landfill
RPD	Relative percent difference
SMS SCO	Sediment Management Standards Sediment Cleanup Objective
SQO	Sediment Quality Objective
SVOC	Semivolatile organic compound
TCLP	Toxicity Characteristic Leaching Procedure
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USEPA	U.S. Environmental Protection Agency
WDNR	Washington State Department of Natural Resources

## 1.0 Introduction

The purpose of this document is to present the Remedial Action Construction Report (RACR) for the cleanup of the recently contaminated sediment area in the vicinity of the Murray Morgan Bridge (MMB), located over the Thea Foss Waterway in Tacoma, Washington (Figure 1.1). From April 2011 through February 2013, the City of Tacoma (City) completed a rehabilitation project of the bridge (MMB Rehabilitation Project). Upon completion of the MMB Rehabilitation Project, metals were detected in surface sediments at concentrations greater than the Sediment Quality Objectives (SQOs) of the Thea Foss Waterway within a focused area underlying the bridge. This contamination is believed to be the result of the rehabilitation construction activities. Based on the City's reporting of this issue to the U.S. Environmental Protection Agency (USEPA), it was determined that a remedial action of the re-contaminated sediments in this area would need to be performed. The objective of this RACR is to present a description and the results of the remedial activities, which were successfully completed per the USEPA-approved Remedial Action Work Plan (RAWP; Floyd|Snider 2015) and approval letter (USEPA 2015a) between February 5 and February 14, 2015. The bridge contractor, PCL Civil Contractors, Inc. (PCL), who completed the MMB Rehabilitation Project on behalf of the City, was responsible for conducting the MMB Remedial Action in accordance with the requirements presented in the RAWP. American Construction Company (American) was retained by PCL to conduct the MMB Remedial Action discussed in this report.

### 1.1 SITE LOCATION AND BACKGROUND

Figure 1.2 presents the MMB Rehabilitation Project location. The MMB is located within the boundaries of the Commencement Bay Nearshore/Tideflats Superfund Site (USEPA 1989). The Thea Foss and Wheeler-Osgood Waterways remediation construction in this portion of the waterway was completed in 2006 by the City under the Remedial Design/Remedial Action Consent Decree (CD) issued by the USEPA in 2003 (USEPA 2003). The City's Operations, Maintenance, and Monitoring Plan (OMMP; City of Tacoma et al. 2006) was prepared following completion of the remedial action to specify the post-construction operations, maintenance and monitoring, and corrective action procedures planned for the site. The OMMP presented a 10-year monitoring schedule, with Year 7 monitoring completed in 2013. Year 10 waterway-wide monitoring will be conducted in 2016. As described in the OMMP, the MMB (also called the 11<sup>th</sup> Street Bridge) overlies an area originally designated as a monitored natural recovery area in the Statement of Work (to the City's CD).

On February 1, 2013, the City reached substantial completion of the MMB Rehabilitation Project. The rehabilitation commenced April 25, 2011, and was conducted to restore traffic to the bridge without load restrictions. The project included significant over-water work, but no in-water work was conducted. Refer to the *Murray Morgan Bridge Rehabilitation: Pre- and Post-construction Sediment Sampling Approach Memorandum* (Floyd|Snider 2011a) for additional details on the rehabilitation work performed during the MMB Rehabilitation Project.

In order to protect the natural recovery area of the Thea Foss Waterway, to evaluate any potential impact from the MMB Rehabilitation Project's over-water work, and to ensure compliance with the CD, the OMMP, and the City's Institutional Controls Plan (City of Tacoma 2006), pre- and post-construction surface sediment sampling were performed under and adjacent to the MMB. This surface sediment sampling identified the impacts to the surface sediments to be addressed by the completed remedial actions described in this RACR. Pre-construction and post-construction surface sediment sampling results were presented in a series of memorandums submitted to USEPA (Floyd|Snider 2011b, 2013, 2014a, 2014b).

In the post-construction sediment sampling results, an elevated concentration of lead was detected in one sample. To confirm the elevated lead result, confirmation and verification sampling was conducted on December 4, 2013. The location of the exceedance was re-sampled as a confirmation sample, and three locations triangulated within approximately 20 feet were sampled to further delineate the extent of the lead exceedance. The surface sediment results from this monitoring event indicated that the extent of the metals exceedances detected in the post-construction and verification samples was not fully defined and additional sampling was needed. Exceedances of copper and zinc were observed in one of the verification samples, and exceedances of lead were observed in two samples. To determine the extent of the metals contamination, additional delineation sampling was conducted on April 22, 2014. A total of eight additional surface grab delineation samples were collected surrounding the original post-construction sample and verification samples. None of the detected concentrations of metals in the delineation samples exceeded the Thea Foss SQOs, indicating that the extent of the metals exceedances detected in the post-construction and verification samples was fully defined and additional sampling was not needed. Additional detail regarding pre- and post-construction sampling can be found in Section 1.2 of the RAWP (Floyd|Snider 2015).

On August 8, 2014, USEPA issued a letter to the City outlining the general approach required to remediate the contaminated sediments (USEPA 2014). USEPA concluded that the work should be performed in accordance with Section VI, Paragraph 13 of the Remedial Design/Remedial Action CD for the Thea Foss and Wheeler-Osgood Waterways. The City issued a written agreement to the approach to USEPA on September 2, 2014.

## 2.0 Summary of Remedial Action and Site Conditions

As described above, on February 1, 2013, the City reached substantial completion of the MMB Rehabilitation Project. Post-construction surface sediment samples indicated the presence of metals at concentrations greater than the Thea Foss SQOs and required remediation. Per the RAWP, the City addressed the contaminated sediments in a focused area underlying the western portion of the bridge at a depth of approximately -25 feet to -30 feet mean lower low water (MLLW) by removal of a minimum of 6 inches of sediments via mechanical dredging, followed by thin-layer capping of the area with clean sand to the existing pre-remedial action surface. In general, remedial action activities were conducted in accordance with the RAWP, the Thea Foss and Wheeler-Osgood Waterways 401 Water Quality Certification (USEPA 2007), and an addendum to the certification (Clean Water Act Section 401 Memorandum; USEPA 2015b), which includes updates and project-specific information for the remedial action. All in-water work was conducted along the western edge of the designated navigation channel, as depicted in Figure 1.2.

The remedial action area was approximately 3,000 square feet and the resulting dredged material volume was approximately 128 cubic yards (CY). The MMB Remedial Action included a number of construction activities, as described in further detail below. These activities took place between February 5 and February 14, 2015, for a total of 8 days. Of those, the in-water remedial action activities comprised 5 days: February 5 and 6 for initial dredging and passive dewatering and February 12 through February 14 for additional high spot dredging, capping, additional passive dewatering, and additional capping to achieve the pre-remedial action surface. The transloading and disposal of the contaminated sediments as Subtitle D (non-hazardous) waste to Republic Services (located in Roosevelt, Washington) occurred on February 27, 2015. A detailed schedule of events is presented in Section 2.1.

All work was completed on February 27, 2015, once transloading and disposal of dredged material occurred. Monitoring of the MMB Remedial Action area will be done as part of future City OMMP monitoring events, with the next event to take place in 2016 (Year 10). The MMB Remedial Action area will be included in the future hydrographic survey subtidal cap areas. Additionally, a compliance surface sediment sample will be collected within the MMB Remedial Action area as part of the future OMMP events to confirm the cap material is not re-contaminated with concentrations of chemicals greater than the Thea Foss SQOs.

### 2.1 REMEDIAL ACTION SUMMARY

An overall summary of the remedial action activities is summarized in Table 2.1, including dates of each activity.

**Table 2.1**  
**Remedial Action Summary**

<b>Remedial Activity</b>	<b>Start Date</b>	<b>Completion Date</b>	<b>Duration</b>	<b>Summary of Activity</b>
Pre-Remedial Action Hydrographic Survey	January 26, 2015	January 26, 2015	1 day	A multi-beam survey was conducted by a licensed surveyor to identify pre-remedial action mudline elevations within the remedial action area.
American Mobilization	February 4, 2015	February 4, 2015	1 day	Mobilization included loading sand cap material from CalPortland onto American's barge, and then moving all equipment from American's facility on the Hylebos Waterway to the remedial action area.
Initial Dredging	February 5, 2015	February 6, 2015	2 days	Dredging of remedial action area; approximately 128 CY in total after subsequent high spot additional dredging.
Initial Dewatering	February 6, 2015	February 6, 2015	1 day	Dewatering system constructed per the RAWP Section 5.4.
Post-Dredge Confirmational Sampling	February 7, 2015	February 7, 2015	1 day	Collection of confirmational surface sediment samples from two locations within the remedial action area.
Interim Post-Dredge Hydrographic Survey	February 8, 2015	February 8, 2015	1 day	Submitted to USEPA and approved on February 10, 2015. Additional high spot dredging occurred in five localized areas.
Additional High Spot Dredging and Lead Line Soundings	February 12, 2015	February 12, 2015	1 day	The five localized high spots were identified and re-dredged with lead line soundings to confirm required mudline elevations had been met.
Initial Capping	February 12, 2015	February 13, 2015	2 days	Capping of remedial action area; approximately 170 CY of cap material in total after additional low spot capping.
Interim Post-Cap Hydrographic Survey	February 13, 2015	February 13, 2015	1 day	Indicated that a number of localized areas required additional capping.

Remedial Activity	Start Date	Completion Date	Duration	Summary of Activity
Additional Low Spot Capping and Post-Remedial Action Lead Line Soundings	February 14, 2015	February 14, 2015	1 day	Low spot sand capping “sprinkling” occurred in the morning with lead line soundings to confirm required mudline elevations had been met.
Post-Remedial Action Confirmational Sampling	February 14, 2015	February 14, 2015	1 day	Collection of confirmational surface sediment samples from two locations within the remedial action area and three locations in the vicinity but outside of the remedial action area.
American Demobilization	February 19, 2015	February 19, 2015	1 day	Following USEPA approval, dredge and receiving barges returned to American’s facility on the Hylebos Waterway.
Transloading and Disposal	February 27, 2015	February 27, 2015	1 day	Transload of nine shipping containers at the American facility, directly to trucks for transport to a nearby railyard. Lined containers transported to Republic Services landfill in Roosevelt, Washington. All containers off-loaded and disposed of at landfill by March 9, 2015.

## 2.2 SITE PREPARATION

### 2.2.1 Agency Coordination and Notifications

A number of notifications were required prior to the commencement of the remedial action:

- USEPA coordinated with U.S. Coast Guard (USCG), United States Army Corps of Engineers (USACE), Washington State Department of Natural Resources (WDNR), and National Oceanic and Atmospheric Administration (NOAA) prior to the commencement of the in-water work. USEPA provided the RAWP to the agencies to inform them of the activities planned. The physical proximity of the work to the navigation channel and how work was expected to impact the navigation channel were also discussed with the USCG and USACE.
- USEPA coordinated with WDNR, NOAA, and Natural Resource Trustees regarding Appendix B of the RAWP, which presented a Biological Evaluation of Endangered Species as an addendum to the Biological Assessment and Biological Opinion for the



Thea Foss and Wheeler-Osgood Waterways Remediation Project (USEPA 2000), determining that the remedial action was not likely to result in adverse effects to either endangered species or habitat.

- USEPA coordinated with WDNR regarding access to the state-owned aquatic lands managed by WDNR. The remedial action work was covered under the existing WDNR Access Agreement.
- The City notified occupants of the marina and nearby residents and businesses of the schedule of remedial action construction activities, bridge closure dates, and the potential need for any boat relocation prior to work commencing. The City also notified the USCG for the required bridge closure dates.
- American posted the USCG Notice to Mariners and was responsible for day-to-day communication with the USCG during the project.

### **2.2.2 Pre-Dredging Hydrographic Survey**

In order to ensure that American removed material to the required 6 inch minimum depth (with an allowable overdredge of a minimum of 6 inches), a multi-beam hydrographic survey was conducted on January 26, 2015 prior to remedial activities to determine the existing surface and the required dredge depth. The hydrographic survey was conducted by a licensed hydrographic surveyor, eTrac. The pre-remedial action hydrographic survey was submitted to the USEPA by email on January 30, 2015.

### **2.2.3 Mobilization**

American equipment mobilized to the site included a dredge barge and receiving barge (both 50 feet by 150 feet) and small support vessels (tugboat and dinghy). The staging of equipment was completed in accordance with USCG regulations. Staging and location of equipment did not interfere with vessel navigation in the Thea Foss Waterway. Because construction activities affected access to the Foss Harbor Marina, the City coordinated with the marina prior to the start of work. MMB was closed to vehicle traffic with the lift span raised to accommodate the dredging and capping operations and marine traffic. Figure 2.1 presents the remedial action area configuration.

## **2.3 DREDGING**

The dredging that occurred on February 5 and 6, 2015 (initial dredging) and the February 12, 2015 additional high spot dredging are described in the following sections. Further details describing dredging processes and BMPs are presented in Section 5.4 of the RAWP.

### **2.3.1 Initial Dredging**

Initial dredging was conducted in accordance with the RAWP and occurred on February 5 and 6, 2015. USEPA provided field oversight during the commencement of dredging on February 5, 2015, and approved the dredging approach during this site visit with the addition of

dredging BMPs, described further in Section 2.3.4. Water quality monitoring was conducted throughout all dredging to ensure that water quality was not impacted at the point of compliance (150 feet from the dredge activities), as required by Appendix C of the RAWP and the Thea Foss and Wheeler-Osgood Waterways 401 Water Quality Certification (USEPA 2007), and addendum to the certification (Clean Water Act Section 401 Memorandum; USEPA 2015b).

Dredging was completed from a dredge barge using a 5-CY clamshell rehandle bucket. The dredging was performed using the BMPs described in the Section 5.4.1 of the RAWP to minimize turbidity and to ensure contamination or re-contamination of the water and the sediments did not occur.

The dredging of contaminated sediments consisted of complete removal of material within the dredge area to a depth of a minimum of 6 inches below the existing mudline. Due to the dredge area being located under the bridge and resulting Global Positioning System (GPS) interference, digital GPS (DGPS) positioning dredge software was not able to be used; therefore, in order to ensure that the dredging was conducted in the appropriate location, a manual grid system was implemented by American. A manual grid was constructed by installing tick marks on the bridge abutment and barge (Appendix A, Photographs 1 and 2), which guided the dredge operator to the various dredge area locations. The grid system (Appendix A, Photograph 3) was a series of 5-foot by 5-foot squares. Each dredge bucket load was represented by one of the grid squares. The dredge depth was controlled by footage markings on the wires that held the bucket and a tide gage placed on the bridge abutment and an adjacent marina pier (Appendix A, Photographs 4 and 5) in order to achieve the correct depth.

Recovered sediments were placed by the bucket directly into lined watertight containers on the receiving barge (Appendix A, Photographs 6 through 8). Eight containers in total were filled with dredged material. The containers were 8-foot by 8-foot by 20-foot steel shipping containers and were made watertight by placing special-made plastic liners 6 millimeter in thickness inside each container. The liners were provided by the disposal company, Republic Services, and were specifically made for these containers and the transportation of contaminated material. In order to ensure that no recovered sediment overflowed directly back to the waterway during the work (including transload), the containers were not overfilled (Appendix A, Photograph 9). In total, including the additional high spot dredging described in Section 2.3.3, 128 CY of dredged material was placed in the containers. The initial dredging activities were completed on February 6, 2015.

### **2.3.2 Post-Dredge Hydrographic Survey**

A multi-beam hydrographic survey was conducted post-dredge on February 8, 2015. The hydrographic survey was again conducted by eTrac, under subcontract to American.

This multi-beam hydrographic survey indicated that both overdredge and underdredge had occurred when comparing to the original pre-remedial action hydrographic survey surface. The sediment material being dredged was composed of fine silts; therefore, it was difficult for the operator to determine the top of the mudline manually, resulting in overdredge in several locations throughout the remedial action area. GPS measurements were presumed to be

inaccurate because of the overhead coverage of the bridge. Additionally, the removal of 6 inches of sediment is typically a minimal thickness that can be achieved with such mechanical dredge equipment.

The overdredge deviated from the allowable overdredge as defined in the RAWP (6 inches) to a depth of up to 34 inches throughout much of the remedial action area, as depicted in Appendix B, Figure B.1A, which presents the interim dredge depths. The interim post-dredge hydrographic survey also indicated that some areas in the remedial action area had high spots, not dredged to the required minimum of 6 inches. A draft of Figure B.1 was submitted to USEPA for review by email on February 10, 2015. In coordination with USEPA, five localized high spots (underdredged areas, approximately 180 square feet in total area) were identified that required additional high spot removal dredging. These high spot areas included two localized areas along the north end of the dredge boundary and three located to the north of sample PD-1 (refer to Figure B.1 for the selected areas). Figure B.1 also shows a high spot area on the south end of the remedial action area. This area was not targeted for additional dredging because it was a considerable distance from the original contamination detected and adjacent to a MMB post-construction delineation sampling location without chemical exceedances of the SQOs.

Regardless of the overdredge, the placement of the thin-layer sand cap was required to be completed to the original pre-remedial action surface, resulting in the application of a greater volume of sand cap than originally anticipated in the RAWP (170 CY, described in Section 2.5).

### 2.3.3 Additional High Spot Dredging

As described in Section 2.3.2, five localized high spot areas were identified, via email with the City and USEPA on February 10, 2015, that required additional dredging. These localized areas were re-dredged on February 12, 2015, prior to the commencement of capping. In accordance with the RAWP and USEPA approval, a hydrographic survey was not required to be repeated following the additional dredging. Instead, lead line soundings were collected by American throughout the newly dredged areas. The areas were determined to have reached the appropriate dredge depth by removing a minimum of 6 additional inches of material, and capping was commenced on February 12, 2015, as described further Section 2.5.

Graphics illustrating the interim and final dredge depths are presented in Appendix B. The top graphic presented in Figure B.1 (B.1A) shows the interim dredge depth, prior to the additional hot spot dredging. It also presents the locations of lead line soundings that were made following additional dredging to remove the identified high spots. Each location shows a -6 value indicating that a minimum of 6 inches of dredged material was removed to achieve the remedial action objective. This was confirmed by American field lead line soundings. Figure B.1B merges the interim post-dredge hydrographic survey data with the additional dredging lead line soundings to depict the final dredge depth.

Cross sections of the pre-remedial action surface compared to the post-dredge surface to present the final dredge depth are shown in the top two (Section 1) panels of Figure B.2. The cross section locations A-A' and B-B' indicate the total inches of material dredged during the remedial action.

Cross section A-A' indicates that a maximum of approximately 30 inches was dredged, and cross section B-B' indicates that a maximum of approximately 20 inches was dredged.

### **2.3.4 Collection of Post-Dredge Confirmational Samples**

After dredging was completed, surface sediment samples (0 to 10 cm) were collected on February 7, 2015, for informational purposes only. The samples were collected from the post-dredge surface to characterize the sediment quality beneath the cap. The interim post-dredge surface ultimately underlies the cap and at project completion is deeper than the final post-remedial action surface and the point of compliance (0 to 10 cm) for the Thea Foss Waterway. Therefore, the data will not be used to evaluate compliance with the CD and OMMP. Post-dredge confirmational sampling is described in further detail in Section 5.1.

## **2.4 DEWATERING**

Following settling of the material in the containers, overlying water was pumped from the containers onto the deck of the receiving barge and through a filtration system to filter the dredge water prior to draining back to the Thea Foss Waterway in an area adjacent to the work area. The total volume of water from the remedial action required to be filtered was approximately 15,000 gallons and was completed within 3 days, on February 6 (after the initial dredging was completed), and on February 12 and 13 (after the completion of dredging both days). On February 6, the water had only settled for approximately 2 hours, and, therefore, water was carefully withdrawn from the top of the water layer, leaving approximately 1 to 2 feet of water above the sediment. This ensured sediment was not pulled directly into the pump and that the water had additional time to settle prior to the dewatering on February 12 and 13. During the dewatering process on February 6, a small turbidity plume at the point of discharge was observed. The filtration system was modified and a number of BMPs implemented to address the turbidity discharge. These are described in detail in Section 3.3.1 and shown in Appendix A (Photographs 11 through 13). Despite the observed turbid discharge, water quality monitoring indicating no water quality exceedance occurred at the 75-foot midpoint location down-current of the dewatering activities.

On February 11, 2015, a memorandum was submitted to USEPA (Appendix C) that summarized the small turbidity plume that was observed during dewatering on February 6, 2015. The memorandum also proposed additional BMPs that could be implemented to prevent further turbid discharge during dewatering (refer to Section 3.3.1 for further detail). Therefore, dewatering for the remaining dredged material was done in accordance with the BMPs specified in the memorandum, as well as additional requirements as directed by USEPA via email on February 11, 2015.

On February 12, 2015, dewatering commenced following additional dredging of high spots and subsequent capping. Per USEPA direction, all additional dredged material from the high-spot dredging was placed in a separate container to allow additional settling time before dewatering. Four of the eight containers that held dredged material from February 5 and 6 dredging were dewatered first because the containers had been left undisturbed for 5 days and the turbidity in

the overlying water was minimal. As described in the February 11, 2015 memorandum, and under USEPA direction, water was removed from the containers using a lower discharge (20 gallons per minute [gpm]) submersible pump. During dewatering, the pump was actively monitored and some water was left on top of the sediment to ensure no sediment uptake into the inlet. The discharge water was visibly clear and there was no turbidity observed in the waterway originating from the filtration system.

On February 13, 2015, following capping, dewatering continued for the three remaining containers that held the first week's dredged material, per USEPA direction. The separate container holding the additional high spot dredged material was dewatered last to allow maximum time for settling. The discharge water from this container was visibly clear and there was no turbidity observed in the waterway originating from the filtration system (Appendix A, Photograph 14).

## **2.5 CAPPING**

The capping that occurred on February 12 and 13, 2015 (initial capping) and the February 14, 2015 additional low spot capping are described in this section. Further details describing the capping processes and BMPs are presented in Section 5.6 of the RAWP.

### **2.5.1 Initial Capping**

Following completion of dredging, the post-dredge hydrographic survey, and the collection of post-dredge surface samples for informational purposes only (described in Section 5.1), a thin-layer sand cap was placed throughout the remedial action area. The cap material gradation and carbon content were in compliance with the specifications in Appendix A of the RAWP. The sand cap material testing results and specification confirmation materials from American are included in Appendix D.

Initial capping was conducted in accordance with the RAWP on February 12 and 13, 2015. Water quality monitoring was conducted during cap placement to ensure that water quality was not impacted at the point of compliance, as required by Appendix C of the RAWP, the Thea Foss and Wheeler-Osgood Waterways 401 Water Quality Certification (USEPA 2007), and the addendum to the certification (Clean Water Act Section 401 Memorandum; USEPA 2015b). Cap placement was conducted following BMPs described in Section 5.6.1 of the RAWP.

Similar to the dredging, a manual grid was used to ensure that the area was covered. American also used the interim post-dredge hydrographic survey to assess the initial sand thickness needed to return to the pre-remedial action surface. American started with the locations requiring the thickest sand placement. Per the RAWP, and in consultation with USEPA via email on February 11, 2015, sand was placed by lowering the bucket underwater to approximately 5 to 10 feet above the sediment surface and slowly releasing the sand via a controlled and slow rate of release while moving the bucket through the dredge area. In order to further control the release of cap material from the bucket, bucket chains were used that restricted the opening of the bucket jaws and provided a more even rate of release (Appendix A, Photograph 15).

The cap material was placed by controlled release from the same 5-CY clamshell bucket used for dredging. Material was uniformly discharged as a stream of material (rather than being abruptly discharged) in order to provide for uniform bottom coverage and minimize impacts to the receiving surface (Appendix A, Photographs 16 to 20).

In order to ensure that the pre-remedial action surface was achieved, American placed a volume of sand equivalent to the quantity of material removed plus an additional factor to account for the spreading and settling of the cap placement due to currents and the sloping nature of the dredge area. The additional volume placed was minimal and did not cause significant high spots and will further spread and settle out over time. The total volume of cap material placed was estimated to be 170 CY after the additional low spot capping.

### **2.5.2 Interim Post-Cap Hydrographic Survey**

A multi-beam hydrographic survey was conducted post-cap placement on February 13, 2015. The hydrographic survey was conducted by eTrac.

This multi-beam hydrographic survey indicated that in some areas the required 6 inches of cap material had not been placed and low spots were observed, requiring additional cap placement. The interim post-cap surface deviated upward (shallower) from the post-dredge surface by up to approximately 30 inches of sand cap material (i.e., additional cap material needed to be placed in areas where greater than 6 inches of material was dredged). The top graphic presented in Figure B.3A shows the interim cap thickness, as well as the locations of lead line soundings that were made following additional capping to further fill the identified low spots (described further below).

### **2.5.3 Additional Capping**

On February 14, 2015, American commenced capping of the remaining areas requiring cap placement. The cap material was placed in a controlled manner according to the process described in Section 2.5.1.

In accordance with the RAWP and USEPA approval, a hydrographic survey was not required to be repeated following the additional capping. Instead, lead line soundings were collected by American throughout the newly capped areas every one to two bucket placements (Appendix A, Photograph 21). Each lead line location, as depicted in the top graphic of Figure B.3A, shows a value that indicates that sufficient cap material was placed to achieve the remedial action objective.<sup>1</sup> The graphics presented in both Figure 2.2 and B.3B merge the post-remedial action

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<sup>1</sup> The placement of a minimum of 6 inches of sand was the remedial action objective as presented in the RAWP. However, in consultation with and with the approval of USEPA, a thinner cap was placed in the southern portion of the remedial action area. This area had not met the dredge depth of 6 inches, but re-dredging was not required in the interest of completing the remedial action prior to the close of the work window, and because it was a considerable distance from the detected locations of contamination. Because the dredge depth did not reach 6 inches, 6 inches of cap was not required to be placed in order to meet the pre-remedial action elevation.



hydrographic survey data with the additional capping lead line soundings to depict the final cap thickness.

Cross sections of the post-dredge surface compared to the post-remedial action surface are presented in the middle two (Section 2) panels of Figure B.2A. These cross section locations A-A' and B-B' indicate the total inches of cap material placed during the remedial action. Cross section A-A' indicates that a maximum of approximately 30 inches was placed, and cross section B-B' indicates that a maximum of approximately 23 inches was placed. When comparing the cross sections to the top two pre-remedial action and post-dredge comparison panels on Figure 2.2, it is clear that, while several areas throughout the remedial action area were dredged to a depth greater than 6 inches, these areas were also capped with a sufficient amount of material to result in a cap thickness of at least 6 inches, providing a surface similar to that of the pre-remedial action surface. For example, cross section A-A' in the Section 1 panel shows that, at approximately 57 feet into the remedial action area from the north (shown along the x-axis), the dredge depth was approximately 30 inches. The corresponding cap material in the Section 2 panel indicates that approximately 24 inches of cap material was placed in this area, resulting in a final cap thickness of 24 inches and a final mudline elevation of -25.1 feet MLLW, similar to that of the pre-remedial action surface of -24.7 feet MLLW.

#### **2.5.4 Collection of Post-Remedial Action Confirmational Samples**

After capping was completed, surface sediment samples (0 to 10 cm) were collected on February 14, 2015 from the thin-layer cap surface after placement to characterize the post-remedial action sediment quality conditions of the remedial area for comparison to the SQOs and as a baseline for comparisons as part of future OMMP monitoring. Additionally, three sample locations from the 2013 and 2014 MMB post-construction sampling events were re-occupied to potentially capture any transport of dredged material associated with tidal movement that occurred during capping. Post-remedial action confirmational sampling is described in further detail in Section 5.2.

### **2.6 FINAL REMEDIAL ACTION OUTCOMES**

The graphic presented in Figure B.4A shows the interim post-remedial action waterway depth, and Figures 2.3 and B.4B show the final post-remedial action waterway depth changes. These figures indicates that, overall, the remedial action objectives were met: dredging and capping were successfully conducted, and the remedial action for the most part did not deepen or shallow the waterway beyond 6 inches, with the exception of small non-contiguous areas.

Cross-sections of the pre-remedial action surface compared to the post-remedial action mudline surface are presented in Figure 2.4 and the bottom two (Section 2) panels of Figure B.2. These cross-section locations A-A' and B-B' again indicate that the final surface of the remedial action area generally deviates no more than approximately 6 inches in depth (deeper or shallower) from the pre-remedial action surface, with small localized areas (less than approximately 285 square feet in size, or 8 percent of the remedial action area) deviating up to 10 inches deeper.

## 2.7 TRANSLOAD AND DISPOSAL OF DREDGED MATERIAL

### 2.7.1 Materials Analysis

Once capping was complete, the containerized material was required to be transported to and disposed of at a licensed landfill. In order to receive approval to dispose of the sediment as Subtitle D (non-hazardous) waste to the Republic Services landfill (Republic) in Roosevelt, Washington, RGA Environmental submitted samples of the dredged water and sediments on behalf of American to the analytical laboratory of Friedman and Bruya on February 10, 2015, for chemical analysis of metals, semivolatile organic compounds (SVOCs), chlorinated pesticides, polychlorinated biphenyls, and total organic carbon. American submitted these samples prior to their de-mobilization from the site. Dredged water (sampled from residual water in the containers) was analyzed for a number of chemicals including metals. Dredged material was analyzed for metals only. Analytical results are presented in Appendix E.

Results of the chemical testing indicated that all of the dredged water was suitable for disposal as non-hazardous waste and was approved by Republic. This water was residual in the dredged material and limited in volume post-dewatering (Appendix A, Photograph 22).

A lead exceedance of the criteria to qualify as a non-hazardous waste (100 milligrams per kilogram [mg/kg]) was detected in the dredged material. The lead concentration in the dredged material sample was 200 mg/kg. Because an exceedance was detected in the dredged material sample, the material was further analyzed using Toxicity Characteristic Leaching Procedure (TCLP). TCLP is a solids sample extraction method for chemical analysis employed to simulate leaching through a landfill. The sample was collected by RGA Environmental on February 20, 2015, and submitted to Friedman and Bruya. TCLP results indicated that the detected lead in the dredged material is not likely to leach, with a reported concentration of less than 0.26 milligrams per liter (mg/L) detected in the extraction solvent, and was, therefore, classified as a non-hazardous waste and accepted for disposal at Republic on February 25, 2015. The dredged material was classified as a contaminated waste (refer to Appendix E for Republic approval materials).

### 2.7.2 Transload and Disposal Process

Upon approval of the material for disposal by Republic, the dredged material in the lined watertight shipping containers on the receiving barge were then transported to American's facility located on the Hylebos Waterway on February 26, 2015. Final dewatering into Baker Tanks (as described in the RAWP) was not required as the material was determined by Republic to be sufficiently dry for disposal (Appendix A, Photograph 22).

The lined watertight containers were transferred to the uplands on February 27, 2015, using a crane to lift each container and place it directly on a truck for transport (Appendix A, Photographs 23 and 24). The containers were then taken directly to the Tacoma intermodal rail facility (Long Haul) where they were loaded onto a train for transport to Republic. There were nine containers in total transported by truck to Long Haul. Eight containers contained dredged material, and one

container was a separate “dry-items-only” container, which contained the dewatering filtration system’s filter fabric and straw logs.

As described in the RAWP, a habitat mitigation area is anticipated to be constructed on American’s facility. There will be a need for compensatory mitigation in the area and the northern portion of American’s property has been identified as a likely area for the mitigation work. However, there is no specific project type, location, or footprint developed yet, nor a specific timeline. This remedial action did not conflict with the development of the mitigation area, and no permanent changes to the transloading area took place that would preclude the use of the area as a habitat mitigation site in the future. Additionally, transloading occurred in the southern portion of the property as described in the RAWP, which currently is not identified as the likely mitigation area.

### 3.0 Water Quality Monitoring Results

#### 3.1 OBJECTIVES

The objective of water quality monitoring was to ensure that in-water activities were accomplished in a manner that provided protection of the environment and minimized the release of turbidity in the Thea Foss Waterway during all remedial activities. The water quality monitoring activities were conducted in accordance with Appendix C of the RAWP and the Commencement Bay Water Quality Certification (USEPA 2007), as amended for the Murray Morgan Bridge Remedial Action (USEPA 2015b).

#### 3.2 APPROACH

##### 3.2.1 Water Quality Monitoring Meter Quality Assurance/Quality Control

Water quality monitoring was conducted using the YSI 6920 Sonde water quality meter rented from Field Environmental Instruments Inc., in Woodinville, WA (FEI). Calibration of the meter was conducted by FEI prior to the first day of dredging and was thereafter conducted daily on-site prior to each use. An employee of FEI also came to the Floyd|Snider office prior to the commencement of remedial activities to demonstrate the proper calibration procedures, in accordance with the manufacturer's guidelines and recommendations. The manufacturer recommendation for water quality meter operation is that it is calibrated monthly during periods of use. For use on this project, the meter was calibrated for the duration of in-water work. Calibration measurements were recorded daily in the field logbook, with the exceptions of February 5 and 12. Calibration for February 5, conducted by FEI prior to the start of in-water work, was not recorded in the field logbook. Additionally, calibration was completed on February 12; however, the measurements were not recorded in the field logbook. Calibration records for February 6, February 13, and February 14 are provided in Appendix D. On-site, the meter was stored in the rental box and in a secured construction trailer overnight. The pH probe was stored in the manufacturer-specified pH solution as recommended.

##### 3.2.2 Monitoring Overview

The monitoring activities included:

1. Visual monitoring and documentation of turbidity throughout the project area and during all in-water work, including dredging, dewatering/filtration, cap placement, and transloading. During visual monitoring, the project area was observed for evidence of turbidity, petroleum sheen, dying or distressed fish, and construction debris.
2. Instrumented monitoring of several conventional parameters (turbidity, dissolved oxygen [DO], temperature, pH) was conducted at a frequency of twice daily during slack and during strong ebb and/or flood tidal conditions (during daylight hours) for the entire length of the in-water project (including dredging, dewatering, and cap placement; Appendix A, Photograph 25). The instrumented monitoring was

conducted only when active work was underway for at least 1 hour. Additional instrumented monitoring during passive dewatering was triggered by the observance of turbidity discharge from the dewatering system per the RAWP.

Instrumented measurements were collected within 3 feet of the water surface, mid-depth in the water column, and within 3 feet of the mudline at the following locations (final field locations presented in Appendix D). The locations varied slightly depending on the location of the in-water activities being conducted during the measurement. The monitoring locations included the following:

- One location on the 150-foot point of compliance boundary downcurrent of the activity.
- One location at the midpoint (75-foot) within the dilution zone downcurrent of the activity.
- One location on the 150-foot point of compliance boundary upcurrent of the activity.
- One reference location outside the point of compliance boundary and between the activity and Commencement Bay.

Water quality monitoring forms are presented in Appendix C, along with a summary table of all measurements and field observations (Table B.1). The water quality forms indicate that water quality exceedances were not observed throughout the duration of the remedial action, with the exception of the one exceedance at the 150-foot point of compliance, described in detail in Section 3.3.1. This exceedance was observed once and not confirmed in the two follow-up water quality measurements. Turbidity was also observed during the passive dewatering on February 6, but did not result in an exceedance at the 75-foot midpoint or the 150-foot point of compliance at any time during dewatering, as described in detail in Section 3.3.2. A summary of all water quality measurements, including references to pertinent photographs, is presented as Table B.1.

### **3.3 RESPONSE ACTIONS TO WATER QUALITY MONITORING**

#### **3.3.1 Water Quality Exceedance during Dredging**

- On February 6, 2015, an exceedance of the turbidity water quality standard at the 150-foot compliance boundary (3-foot depth) was measured during dredging and dredging was immediately ceased. Per the RAWP and the 401 Water Quality Certification (USEPA 2007, USEPA 2015b), work stoppage is triggered if the turbidity value exceeds 10 Nephelometric Units [NTU] over the ambient turbidity when the ambient turbidity is 50 NTU or less. The exceedance was a turbidity value of 11.2 NTU greater than the ambient turbidity measurement (3.2 NTU versus 14.4 NTU). Shortly after, the exceedance was reported to the City and USEPA by phone.
- Concurrent with the notification to USEPA and while the dredging still remained stopped and the source of the impact assessed, a second series of water quality measurements was collected. These measurements indicated that the turbidity value

at the 150-foot compliance boundary (3 foot depth) was now in compliance with a value of 10.7 NTU. The measurement collected upcurrent showed a similar turbidity value of 10.3 NTU. USEPA then communicated by phone and email that the field team was to wait 20 minutes after the second series of measurements were collected and then collect a third series of water quality measurements. If the measurements indicated no exceedances, dredging could continue. USEPA also required implementation of a series of additional BMPs to address the exceedance. Specifically, the dredge operations were slowed down, and American kept the bucket near the water surface to dewater for a longer period of time than they had previously, prior to transporting and dumping on the barge.

- The third series of water quality measurements collected after 20 minutes did not show exceedances and showed turbidity values similar to the second series, with a value of 10.4 NTU collected at the 150-foot compliance boundary (3-foot depth). Therefore, dredging recommenced, with the remaining dredging completed within 30 minutes.

### 3.3.2 Turbidity Discharge during Passive Dewatering

As described in Section 2.4, a memorandum that summarized actions that were taken in response to the turbidity discharge observed during water quality monitoring conducted throughout passive dewatering was submitted to USEPA on February 11, 2015 (provided in Appendix C). The memorandum summarized all of the additional BMPs implemented during dewatering, presented below. The additional BMPs implemented are also discussed as part of the lessons learned during the project, in Section 7.0.

The original design of the filtration system as proposed in the RAWP consisted of an 11-foot by 12-foot by 3-foot-tall enclosure consisting of straw bales lined with non-woven geotextile filter fabric (PermeaTex Nonwoven Geotextile Model No. 4080). A 3-inch diaphragm pump was to be used to pump the water at approximately 80 gpm from the containers into the easternmost end of the enclosure, furthest from the scupper where discharge would occur. During initial dewatering activities, a pump discharging at 100 gpm was used. The intent of the filtration system was to use approximately 100 square feet of vertical surface to filter the dredge water (50 feet by 2 feet). However, the design of the filtration system initially resulted in water directly filtered through the fabric, running the length of the barge prior to discharging back into the Thea Foss waterway through the scupper at the end of the filtration system. The location of the filtration system is presented in Figure 2.1.

On February 6, 2015, while implementing the filtration system described above, a turbidity plume was observed upon commencement of dewatering below the western discharge point/scupper of the dewatering system. It was estimated that the plume was approximately 10 to 20 feet long, 5 to 10 feet wide, and 2 feet deep (Appendix A, Photograph 11). A number of BMPs were implemented to reduce the release of turbid water, and water quality monitoring activities were also conducted in response to the visible turbidity plume, as described later in this section.



Due to the lean of the receiving barge, water was hitting the base of the dewatering area on the eastern end and flowing across the barge deck (and within the dewatering area) to the discharge point/scupper on the western side rather than discharging to the closer, eastern discharge point/scupper. In order to address the turbidity, the dewatering hose was moved to the western side of the dewatering area to facilitate discharge through the following additional BMPs:

1. The discharge hose was confirmed to be pulling water from 1 to 2 feet above the sediment in the containers to prevent sediment uptake into the hosing.
2. Additional layers of geotextile fabric were placed along the inside of the western wall of the dewatering area, directly on top of the discharge point (Appendix A, Photograph 12).
3. Straw wattles were placed on top of the additional layers of geotextile along the inside of the western wall of the dewatering area (Appendix A, Photograph 12).
4. Two straw wattles were wrapped in geotextile fabric and placed on the outside of the western wall of the dewatering area (directly after discharge at the corner scupper) to provide an additional layer of filtration prior to discharge to the waterway (Appendix A, Photograph 13).

Upon implementation of the BMPs, American was directed to recommence dewatering. Shortly thereafter, a small turbidity plume became visible at the western discharge point/scupper. This turbidity plume appeared to be less turbid than the initial turbidity plume, indicating the BMPs were successful in reducing the turbidity of discharge water. However, because the water leaving the west discharge point/scupper was still slightly turbid, American stopped dewatering again immediately. The pump discharge rate was determined to be on its lowest speed. Further BMPs then implemented to further minimize turbidity included:

1. Several more layers of geotextile fabric were placed along the inside corner of the dewatering area, on top of the west discharge point/scupper.
2. Four additional straw wattles were placed along the inside of the western wall (above the additional geotextile fabric) of the dewatering area (for a total of six) and two of them were wrapped in geotextile fabric.
3. The two straw wattles were confirmed to still be placed correctly on the outside of the western wall, directly on top of the western discharge point/scupper.

Once these BMPs were implemented, American continued dewatering and commenced water quality monitoring to confirm that the turbidity was not impacting the midpoint or compliance monitoring locations. Turbidity measurements were collected at the 75-foot midpoint station. During turbidity monitoring, the plume was observed to shift direction and move north. Therefore, the 75-foot midpoint location was shifted to the north, downcurrent of the plume. Measurements were collected every few minutes at depths of 3 feet and 5 feet below the water surface. In order to confirm the plume was only present on the surface and not at depth, American collected three turbidity measurement at 10 feet and 20 feet below the water surface. Turbidity measurements ranged from 10.2 to 10.7 NTUs and were consistent with turbidity

measurements collected throughout the day at the compliance and reference monitoring locations (ranging from 10.1 to 13.0 NTU, with the majority of measurements ranging between 10.1 and 10.9; refer to Appendix C).

### 3.3.3 Water Quality Instrument Malfunction during Capping

- During capping activities on February 14, 2015, the water quality instrument malfunctioned and visual water quality observations were done in lieu of collecting instrument measurements. Upon arriving at the site on February 14, 2015, the water quality instrument was calibrated. The subsequent calibration readings matched the target numbers specified in the user's manual. American collected the reference station readings but noticed the DO readings to be unusually low, indicating a potential issue with the instrument. The instrument was re-calibrated but did not meet the target numbers specified in the user's manual. The water quality team contacted the manufacturer of the instrument and spent time trying to troubleshoot; however, the manufacturer determined that the instrument required professional servicing, which was not available at the time.
- In order to ensure water quality criteria were being met at the points of compliance, it was determined by the water quality team and project manager that visual observations should be recorded. Photographs were taken at both the midpoint locations and the 150-foot point of compliance location during the capping activities. There were no observations of turbidity at any of the locations and water was visibly clear (Appendix A, Photograph 26). However, during the second daily water quality monitoring event, dark brown bubbles were observed on the water surface at the midpoint 75-foot location (Appendix A, Photograph 27). It was suspected that the substance was residual organic carbon amendment from capping. In order to verify this, the water quality team mixed organic carbon amendment with site seawater and the resulting material was confirmation that the dark bubbles observed in the capping area were associated with the organic carbon amendment mixed in the sand capping material. When the field representative tried to touch the bubbles, there was no material to grab or collect—it dissipated quickly and was gone.

## 4.0 Thin-Layer Sand Cap Material Testing

### 4.1 THIN-LAYER SAND CAP COMPLIANCE WITH SPECIFICATIONS

The material for the thin-layer sand cap to be placed following dredging was required to meet both the chemical and physical characteristics of the Thea Foss and Wheeler-Osgood Waterways Remediation Project specifications. The relevant requirements are identified in Part 2.04 of Section 02215 – Channel Sand Cap Material – Capping and Part 2.02.D of Section 02200 – Borrow Source Characterization – Earthwork of the Thea Foss and Wheeler-Osgood Waterways Remediation Project specifications, which is provided in Appendix A of the RAWP. American was required to conduct sampling and provide documentation of the sampling and compliance with the specifications to the City prior to the start of remedial activities. Required sampling included: grain size distribution, particle specific gravity, modified proctor, weight per unit volume, priority pollutant metals, volatile organic compounds, SVOCs, chlorinated pesticides, polychlorinated biphenyls, and total organic carbon.

The sand cap material was sourced from CalPortland (sand product #7143) in Dupont, Washington, on January 30, 2015, for chemical and physical analysis. Grain size specifications for the cap material are presented in Appendix A of the RAWP. The gradation of the sand was provided by CalPortland and met the requirements with the exception of the U.S. No. 4 sieve—the specification calls for 85 to 100 percent passing and the cap material sourced was 81 percent. The gradation specifications of the sand cap were submitted to USEPA for review on January 21, 2015, with approval received by email on January 22, 2015.

The material was also tested for all other chemical and physical parameters in accordance with the specifications. For the chemical testing, the specifications required the material to meet concentrations less than half the Thea Foss SQOs or half the Sediment Management Standards Sediment Cleanup Objectives (SMS SCOs). There were no detections of analytes in the sand cap material with the exception of some metals (arsenic, copper, lead, nickel, and zinc) and 2-methylphenol. The chemical analysis indicated the material did not have concentrations of chemicals greater than half of the Thea Foss SQOs or SMS SCOs. The original Thea Foss Waterway sand cap specifications also called for concentrations less than half of the MTCA criteria for soil protective of groundwater. These calculated concentrations based on MTCA Equation 747-1 are extremely low and often unachievable in analytical testing. They have also never been used to evaluate compliance in the Thea Foss Waterway. Therefore, the City approved the capping material irrespective of the MTCA calculated criteria. This information was relayed to USEPA on February 3, 2015, who approved the cap material for use. Results of all chemical analysis of the sand cap material are presented in Appendix D.

The specifications also call for the amendment of 0.1 percent total organic carbon to the cap material. Activated carbon for this purpose was sourced from Calgon Carbon in Pittsburgh, Pennsylvania (product OLC 12x40) on January 21, 2015. Chemical analysis was conducted on the activated carbon. Although only low level copper was detected in the material, detection limits of a number of chemicals were greater than the Thea Foss SQOs. However, since the analytes

were all non-detect and the volume of carbon to be added to the sand was such as small amount, the City elected to proceed with its use assuming the addition of the carbon would not result in an exceedance of the mixed cap material due to the dilution with the sand cap material. Again, this information was relayed to USEPA on February 3, 2015, who approved the activated carbon for use. Results of all chemical analysis of the activated carbon are presented in Appendix D. As American was loading the sand cap on the barge via conveyor, the activated carbon was sprinkled on the sand cap material to mix the activated carbon throughout. The sand material was amended with approximately 500 pounds of activated carbon in total to obtain a 0.1 percent total organic carbon content. The amount of activated carbon required was based on the determination, per percent by weight, that 2 pounds of carbon were required for every ton of sand. American sourced 250 tons of sand, requiring 500 pounds of activated carbon.

## **4.2 DATA QUALITY REVIEW**

A Compliance Screening, Tier 1 data quality review was performed on the data from both the sand cap material and the activated carbon. A total of two cap material samples were submitted in two sample delivery groups, 580-47190-2 (sand cap) and 580-47198-1 (activated carbon), to Test America of Tacoma, Washington, for chemical analysis. The analytical holding times were met and the method blanks had no detections. The matrix spike (MS), matrix spike duplicate (MSD), laboratory control sample (LCS), and laboratory control sample duplicate (LCSD) recoveries, and the MS/MSD and LCS/LCSD relative percent differences (RPDs) all met USEPA requirements. Sample 7050-01 (activated carbon) had low surrogate recoveries for USEPA Methods 8270D, 8081B, and 8082A, which is attributed to the high total organic carbon concentration in the activated carbon sample. All analyte concentrations for this sample by these methods were non-detects, and it is with professional judgment that they be qualified "UJ" and be considered estimated.

Data are determined to be of acceptable quality for use as qualified.

## 5.0 Surface Sediment Sampling Results

Confirmational surface sediment sampling was performed both post-dredge and post-remedial action to ensure compliance with the Thea Foss and Wheeler-Osgood Waterways CD, the City's OMMP (City of Tacoma et al. 2006), and the City's Institutional Controls Plan (City of Tacoma 2006), for the protection of the natural recovery areas of the Thea Foss Waterway, and to characterize sediment quality conditions post-remedial action. All sampling was performed in accordance with the City's OMMP (City of Tacoma et al. 2006). The sample characterization is described in this section.

### 5.1 POST-DREDGE SURFACE SEDIMENT SAMPLING

#### 5.1.1 Sampling Methodology Summary

Surface sediment samples were collected on February 7, 2015, in accordance with the methodology described in Appendix D of the RAWP from the post-dredge surface (prior to capping) to characterize the sediment quality beneath the cap for informational purposes. The interim post-dredge surface ultimately underlies the cap and, at project completion, is deeper than the final post-remedial action surface and the point of compliance (0 to 10 cm) for the Thea Foss Waterway. Therefore, the data will not be used to evaluate compliance with the Thea Foss SQOs during this remedial action or future OMMP sampling events.

The surface sediment samples (0 to 10 cm) were collected from grabs using a Van Veen grab sampler. Acceptable penetration (i.e., 10 cm or greater) was achieved at both sampling locations. Surface sediment samples were collected from two locations (PD-1 and PD-2) within the remedial action area (Figure 5.1). These locations are approximate because of GPS interference under the MMB and locations were determined based on reference points to the MMB. The samples were collected approximately 15 feet east of the bridge, and approximately 30 to 35 feet and 60 to 65 feet south of the northernmost side of the MMB abutment (refer to Figure 5.1 for sample locations). All sediment samples were visually classified and the total penetration measured. No evidence of contamination (i.e., sheen or chemical odor) or anthropogenic debris were observed in the samples. The sediment descriptions, penetration depth, and sampling time were recorded on sample collection forms, presented in Appendix F.

The individual sediment samples were placed in a decontaminated stainless steel bowl and homogenized until the sediment was uniform in color and texture. Appropriate sediment sampling containers were filled with the homogenized sediment, the sample labels completely filled out, and the containers stored on ice.

Upon the completion of sampling, the samples stored in the coolers containing ice were submitted under a chain-of-custody to Fremont Analytical on February 7, 2015, for analysis of the City OMMP target metals (mercury, lead, zinc, and copper), total organic carbon, and total solids.

### 5.1.2 Sampling Results

Sampling results are presented in Table 5.1. A comparison of SQOs is included in Table 5.1 as well, for informational purposes only. Results indicate that lead and mercury concentrations greater than their SQOs were detected in PD-1. The concentration of lead in PD-1 was 646 mg/kg with an enrichment ratio of 1.44 compared to the SQO of 450 mg/kg. The concentration of mercury in PD-1 was 1.07 mg/kg, with an enrichment ratio of 1.81 compared to the SQO of 0.59 mg/kg. Copper and zinc concentrations were less than their respective SQOs. For sample PD-2 and the field duplicate collected at PD-2, all results were less than their SQOs. Exceedances of the SQOs are not unexpected considering the MMB overlies an area originally designated as a monitored natural recovery area. Because the area was ultimately capped and the point of compliance is within the cap material, these exceedances are not a concern during future OMMP monitoring.

Table 5.2 presents a comparison of post-dredge samples PD-1 and PD-2 to the 2013 MMB post-construction samples that identified and verified the metals exceedances in the remedial action area. These samples were collected during the 2013 MMB post-construction sampling events (with the last six digits denoting the sampling date): MMB-6b-050113, MMB-6-V2-122013, and MMB-6-V3-122013. All three of the 2013 MMB post-construction samples had exceedances of SQOs. MMB-6b-050113 and MMB-6-V3-122013 had exceedances of lead (with enrichment ratios of 1.61 and 1.83, respectively), and MMB-6-V2-122013 had exceedances of copper, lead, and zinc (with enrichment ratios of 2.12, 5.98, and 1.90, respectively).

Laboratory reports are presented in Appendix G.

### 5.1.3 Data Quality Review

A Compliance Screening, Tier 1 data quality review was performed on total organic carbon and metals data resulting from laboratory analysis. The analytical data were validated in accordance with the *USEPA National Functional Guidelines for Superfund Organic Methods Data Review* (2014) and *USEPA National Functional Guidelines for Inorganic Superfund Data Review* (2014).

A total of three sediment samples and one rinsate water sample were submitted in one sample delivery group, FA1502094, to Fremont Analytical of Seattle, Washington, for chemical analysis. The analytical holding times were met and the method blanks had no detections. The MS, MSD, LCS recoveries, and MS/MSD RPDs all met USEPA requirements.

The laboratory performed sample/sample duplicate analysis on sample MMB-PD1 for all analytes to obtain RPDs. The RPD for lead was 67 percent, outside the laboratory control limit of 20 percent. Per USEPA guidelines, the result should be qualified "J" as estimated. Due to the non-homogenous nature of sediment samples, it is with professional judgment that no other lead results for the sediment samples be qualified based on this RPD information.

Data are determined to be of acceptable quality for use as qualified.



## 5.2 POST-REMEDIAL ACTION CONFIRMATIONAL SAMPLING

### 5.2.1 Sampling Methodology Summary

Confirmational surface sediment samples were collected on February 14, 2015, from the post-remedial action surface after thin-layer cap placement to characterize the post-remedial action sediment quality conditions for comparison against the Thea Foss SQOs and future OMMP monitoring events. The next OMMP monitoring event will take place in 2016 (Year 10). A new sample, co-located with one of the post-remedial action sampling locations from within the remedial action area will be collected at that time and in future area or waterway monitoring events and compared against the Thea Foss SQOs.

The surface sediment samples (0 to 10 cm) were collected from grabs using a Power Grab sampler. Acceptable penetration (i.e., 10 cm or greater) was achieved at each sampling location. Surface sediment grab samples collected from two locations (PC-1 and PC-2) within the remedial action area were originally proposed in the RAWP (refer to Figure 5.1 for sample locations). These locations were proposed to be co-located with the post-dredge samples. Similar to samples PD-1 and PD-2, these locations are approximate because of GPS interference under the MMB and were determined based on reference points to the MMB. The samples were collected approximately 15 feet east of the bridge, and approximately 30 to 35 feet and 60 to 65 feet south of the northernmost side of the MMB abutment. Therefore, the co-location of the post-dredge and post-remedial action samples is approximate. All sediment samples were visually classified and the total penetration measured. No evidence of contamination (i.e., sheen or chemical odor) or anthropogenic debris were observed in the samples. The sediment descriptions, penetration depth, and sampling time were recorded on sample collection forms, presented in Appendix F.

On February 5, 2015, during the dredging of the remedial action area, USEPA proposed while on-site that two additional samples be collected outside of the remedial action area to characterize the sediment quality adjacent to the remedial action area and to potentially capture any transport of dredged material associated with tidal movement that occurred during dredging or capping. Similar to the post-dredge samples, the samples were intended to be used for informational purposes only and, therefore, will not be sampled in future OMMP sampling events. Two post-remedial action sampling locations were formally proposed to USEPA by the City and Floyd|Snider in an email on February 5, 2015. The samples previously collected during the 2013 and 2014 MMB post-construction sampling events (MMB-6-D1-042214 and MMB-6-D7-042214) were proposed to be re-occupied in this sampling event to compare the results of the metals analysis. The previous metals concentrations at these locations ranged from 0.18 to 0.68 times the SQO. USEPA proposed an additional sampling location from the 2013 MMB post-construction samples to be re-occupied, MMB-6-V1-122013. Surface sediment samples were, therefore, collected at all three of these locations in addition to locations PC-1 and PC-2 on February 14, 2015. Figure 5.1 identifies the sample locations for the five post-remedial action samples collected.

As described on the sample collection forms, for two of the samples located outside of the remedial action area (MMB-6-V1-122013 and MMB-6-D7-042214) cap material was collected in

the first sample attempt. The second attempts for both were, therefore, moved to a sample location farther (intended to be approximately 10 feet) from the presumed extent of the cap area. However, it was difficult to estimate a distance of 10 feet between the existing 2013 and 2014 MMB post-construction locations and the location identified for the second sampling attempt, particularly because of the GPS interference under the bridge. As a result, these locations were both located approximately 20 feet from the existing 2013 and 2014 MMB post-construction sampling locations. The sample re-occupied (MMB-6-D1-042214) was located closer to the existing location, but was still approximately 10 feet further south.

After collection, the samples were submitted to Fremont Analytical on February 14, 2015, for analysis of the City OMMP target metals (mercury, lead, zinc, and copper), total organic carbon, total solids, and grain size under chain-of-custody.

### 5.2.2 Sampling Results

Post-remedial action sampling results are presented in Table 5.3. Results indicate that all concentrations of metals detected are significantly less than their respective SQOs (refer to Table 5.3 for all enrichment ratios). Additionally, the results for PC-1 and PC-2 indicated the material reached the targeted total organic carbon content of 0.1 percent, with percentages of 1.05 and 1.51 percent, respectively. Grain size measurements for samples PC-1 and PC-2 indicate that the material is composed of medium to coarse sand.

Table 5.3 also presents the sampling results for MMB-6-V1-021415, MMB-6-D1-021415, and MMB-6-D7-021415, which were re-occupied during the post-remedial action sampling, with all concentrations of metals detected at levels significantly less than their respective SQOs as well (refer to Table 5.3 for all enrichment ratios). Grain size measurements for these samples indicate that the material is composed to silty fine sand.

Table 5.4 presents a comparison between the sample locations previously sampled in the 2013 and 2014 MMB post-construction sampling events (MMB-6-V1-122013, MMB-6-D1-042214, and MMB-6-D7-042214) against the re-occupied locations post-remedial action (MMB-6-V1-021415, MMB-6-D1-021415, and MMB-6-D7-021415). Results indicate that concentrations of all metals in the original and re-occupied locations are quite similar, and the sediments located outside of the remedial action area are not impacted by the remedial action.

Laboratory reports are presented in Appendix G.

### 5.2.3 Data Quality Review

A Compliance Screening, Tier 1 data quality review was performed on total organic carbon and metals data resulting from laboratory analysis. The analytical data were validated in accordance with the *USEPA National Functional Guidelines for Superfund Organic Methods Data Review* (2014) and *USEPA National Functional Guidelines for Inorganic Superfund Data Review* (2014). Grain size was also analyzed; however, it does not have data quality compliance requirements.

A total of six sediment samples and one rinsate water sample were submitted in one sample delivery group, FA1502167, to Fremont Analytical of Seattle, Washington, for chemical analysis.

The analytical holding times were met and the method blanks had no detections. The MS, MSD, LCS recoveries, sample/sample duplicate RPDs, and MS/MSD RPDs all met USEPA requirements.

No qualifiers were added to the analytical results based on the data quality review.

Data are determined to be of acceptable quality for use as reported by the laboratory.

## 6.0 Summary of Remedial Actions within the Navigation Channel

Between February 5 and February 14, 2015, the City addressed contaminated sediments in an approximately 3,000 square foot area underlying the western portion of the bridge within the navigation channel (refer to Figures 1.2 and 2.1) at a depth of approximately -25 feet to -30 feet MLLW by removal of a minimum of 6 inches of sediments with a 6-inch allowable overdredge, followed by thin-layer capping of the area with clean sand to approximately the existing pre-remedial action surface. In general, remedial action activities were conducted in accordance with the RAWP and the Thea Foss and Wheeler-Osgood Waterways 401 Water Quality Certification (USEPA 2007, USEPA 2015b).

This section is intended to be a summary of remediation actions conducted within the navigation channel to provide for efficiency of regulatory agency review of remedial activities. Presented below is a brief summary of the in-water work conducted within the navigation channel, detailed further in Section 2.0. Photographs of activities are presented in Appendix A. Sediment sampling also occurred during remedial activities but a summary is not presented here; sampling is detailed in Section 5.0. Because all of the in-water work was conducted within the navigation channel, USEPA coordinated with the USCG and USACE prior to the commencement of the work to inform them of the activities planned and how work was expected to impact the channel.

- **Pre-dredging hydrographic survey.** In order to ensure that the contractor, American, removed material to the required 6-inch minimum depth (with an allowable overdredge of 6 inches), a multi-beam hydrographic survey was conducted prior to remedial activities on January 26, 2015, to determine the existing surface and the required dredge depth.
- **Mobilization.** American equipment mobilized to the Site included a dredge barge and receiving barge (both 50 feet by 150 feet), and small support vessels (tugboat and dinghy), which were then staged in the navigation channel, in accordance with USCG regulations. Staging and location of equipment did not interfere with vessel navigation in the Thea Foss Waterway.
- **Removal of metal-contaminated sediments via mechanical dredging.** Dredging on the remedial action area occurred on February 5, 6, and 12. Further details describing dredging processes and BMPs are presented in Section 5.4 of the RAWP. All dredging activities were conducted in accordance with the RAWP, as well as additional BMPs implemented during remedial activities, discussed further in Section 2.3.

USEPA provided field oversight during the commencement of dredging on February 5, 2015, and approved the dredging approach during this site visit with the addition of dredging BMPs, described further in Section 7.0. Water quality monitoring was conducted throughout all dredging to ensure that water quality was not impacted at the point of compliance (150 feet from the dredge activities). Water quality monitoring is discussed further in Section 3.0.

The dredging of contaminated sediments consisted of complete removal of material using a 5-CY clamshell rehandle bucket within the dredge area using a manual grid system. The manual grid system was employed because GPS measurements were presumed to be inaccurate due to the overhead coverage of the bridge.

Recovered sediments were placed by the bucket directly into lined watertight containers located on the receiving barge. Eight containers in total were filled with dredged material. In total, 128 CY of dredged material was placed in the containers.

- **Dewatering.** Following settling of the material in the containers, overlying water was pumped from the containers onto the deck of the receiving barge and through a filtration system to filter the dredge water prior to draining back to the Thea Foss Waterway in an area adjacent to the work area. The total volume of water from the remedial action required to be filtered was approximately 15,000 gallons and was completed within 3 days, on February 6, 12, and 13.

During the dewatering process on February 6, a small turbidity plume at the point of discharge was observed, though a water quality turbidity exceedance was not measured. The filtration system was modified and a number of BMPs implemented to address the turbidity discharge. These are described in detail in Section 3.3.2 as well as in the memorandum included in Appendix C. Upon implementation of additional BMPs, further turbidity was not observed at the point of discharge.

- **Post-dredge channel elevation confirmation.** To confirm that the required design depth of 6 inches below mudline was reached, two methods were used:
  - A post-dredge multi-beam hydrographic survey was conducted following the completion of dredging on February 8, 2015. The multi-beam hydrographic survey indicated that both overdredge and underdredge had occurred compared to the original pre-remedial action hydrographic survey surface, ranging from -3 to 34 inches.
  - Additional high spot dredging in five localized high spot areas was conducted on February 12, 2015. In accordance with the RAWP and USEPA approval, a hydrographic survey was not required to be repeated following the additional dredging. Instead, lead line soundings were collected throughout the newly dredged areas. The areas were determined to have reached the appropriate dredge depth by removing a minimum of an additional 6 inches of material. The final dredge depth ranged from 12 to 34 inches.
- **Placement of a thin-layer sand cap over the dredged area.** Following completion of dredging, a thin-layer sand cap was placed throughout the remedial action area. Water quality monitoring was conducted during cap placement to ensure that water quality was not impacted at the point of compliance described further in Section 3.0. Cap placement was conducted following BMPs described in Section 5.6.1 of the RAWP. Similar to the dredging, a manual grid was used to ensure that the remedial area was covered.

In order to ensure that the pre-remedial action surface was achieved, 128 CY was placed, plus an additional factor to account for the spreading and settling of the cap placement due to currents and the sloping nature of the dredge area that will occur over time. The total volume of cap material placed was estimated to be 170 CY. This volume was greater than originally anticipated in the RAWP due to the overdredge.

- **Post-cap channel elevation confirmation.** Consistent with the post-dredge survey, a multi-beam hydrographic survey was conducted post-cap placement on February 13, 2015. This multi-beam hydrographic survey indicated that in some areas 6 inches of cap material had not been placed and low spots were observed, requiring additional sand placement.

On February 14, 2015, American commenced capping of the remaining areas requiring cap placement. After placement, lead line soundings were collected. Lead line measurements confirmed that sufficient cap material was placed to achieve the remedial action objective, with cap thickness ranging from 2 to 30 inches.<sup>2</sup>

- **Final remedial action outcomes.** Figure 2.2 shows the navigation channel depth difference between the pre-remedial action surface and the post-remedial action surface. The data presented in this figure indicate that, overall, the remedial action objectives were met: dredging and capping were successfully conducted, and the remedial action for the most part did not deepen or shallow the waterway beyond 6 inches. Again, the spreading and settling of the cap placement due to currents and the sloping nature of the dredge area is expected to occur over time.

Cross-sections of the pre-remedial action surface compared to the post-remedial action mudline surface are presented in Figure 2.3. These cross-section locations A-A' and B-B' also show that the final surface of the remedial action area generally deviates no more than approximately 6 inches in depth (deeper or shallower) from the pre-remedial action surface, with small localized areas (less than approximately 285 square feet in size, or 8 percent of the remedial action area) deviating up to 10 inches deeper.

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<sup>2</sup> The placement of a minimum of 6 inches of sand was the remedial action objective as presented in the RAWP. However, in consultation with and with the approval of USEPA, a thinner cap was placed in the southern portion of the remedial action area. This area had not met the dredge depth of 6 inches, but re-dredging was not required in the interest of completing the remedial action prior to the close of the work window, and because it was a considerable distance from the detected locations of contamination. Because the dredge depth did not reach 6 inches, 6 inches of cap was not required to be placed in order to meet the pre-remedial action elevation.



## 7.0 Remediation Plan Deviations and Lessons Learned

In general, the MMB remedial action was conducted in accordance with the RAWP and the Thea Foss and Wheeler-Osgood Waterways 401 Water Quality Certification (USEPA 2007), and the addendum to the certification (Clean Water Act Section 401 Memorandum; USEPA 2015b). However, some deviations did occur during the course of the remedial activities, resulting in useful lessons learned for agencies, contractors, and consultants to be applied on future dredging and capping projects. The table below presents both project deviations from the RAWP as well as adaptive management approaches, and the resultant lessons learned.

RAWP Deviations & Adaptive Management Items	Lessons Learned
<p>Communication protocols established in the work plan were not all followed on all occasions. For example, USEPA was not informed of the water quality instrumentation malfunction on the Saturday during dredging, the day it occurred. Due to an oversight by project personnel, USEPA was also not notified that the truck transport of the dredged material was occurring prior to the start of the transport activities. The dredged material was transported and disposed of at LRI Landfill in accordance with the RAWP.</p>	<p>For future projects, a pre-construction briefing should be held where, amongst other topics, the communication protocols are discussed to ensure that all parties have consistent expectations for agency notifications and communication methods, including specific agency communication preferences for weekends and holidays.</p>
<p>USEPA expressed concern that the open-top rehandling bucket that was used per the approved RAWP was not appropriate for dredging the fine-grained contaminated sediments. Based on observations during dredging, there was clearly loss of silty grained material out of the top of the bucket.</p>	<p>The open-top rehandling bucket was selected based on its availability given the timing of the remedial action, and in the interest of dredging the contaminated sediments as soon as possible from the waterway, prior to the closure of the 2015 in-water work window, rather than waiting until the subsequent in-water work window.</p> <p>However, in the future for a similar project, sediment composition and dredge depth should be considered when selecting the appropriate dredging equipment. Provided that the project does not include substantial debris or a slope, an environmental bucket is more appropriate if the dredge material is fine-grained, minimizing the loss of the material the bucket.</p> <p>During the cap placement in the remedial action area, the rehandle bucket opening was restrained with chains and binder hooks to have an adjustable opening, allowing for more controlled cap placement. This approach could be used on other capping projects.</p>

RAWP Deviations & Adaptive Management Items	Lessons Learned
<p>The use of the 5-CY rehandle bucket to achieve the desired 6- to 12-inch dredge cut (a minimum 6 inches with a 6-inch allowable overdredge per the RAWP) was challenging, as much of the dredging removed between 12 and 34 inches of sediment. Therefore, while the target material was removed, there was an increase in the anticipated overdredge (resulting in additional dredge materials for disposal and additional capping material for placement). Despite the overdredge, the remedial action met its objectives of removing the contaminated sediment, covering the remedial action area with a thin layer sand cap, and returning the navigation channel to approximately the same pre-remedial action elevation.</p>	<p>Future projects to be conducted under similar circumstances (thin dredge cut, soft fine grain sediments, and obstruction preventing the use of DGPS) should consider different options for dredging, such as a smaller environmental clamshell bucket.</p>
<p>Additional detail regarding the water quality monitoring procedures was needed by the Contractor to ensure that all monitoring aspects were conducted in accordance in the RAWP.</p>	<p>A face-to-face or conference call briefing with the construction and oversight Contractors about water quality monitoring activities prior to the initiation of those activities should have been conducted. Such a briefing would ensure that the Contractors are clear about the reasons/objectives for monitoring, that all entities are clear on methodologies to be employed, and that monitoring equipment is identified and its operation is understood. It would be helpful to discuss potential water quality scenarios with the Contractor and agency representatives so that there is a shared understanding of expectations and agreed to response actions can be determined in advance.</p>
<p>Water quality monitoring stations were not consistently labeled day-to-day during in-water activities leading to difficulty in review and comparison of daily monitoring activities.</p>	<p>Consistent labeling of the monitoring stations would allow more clarity as to how the monitoring was being conducted throughout the duration of the in-water work. For example A=reference location, B=150-foot boundary upcurrent, C=75-foot boundary upcurrent, D=75-foot boundary downcurrent, and E=150-foot boundary downcurrent.</p>

RAWP Deviations & Adaptive Management Items	Lessons Learned
<p>During USEPA's site visit, water was observed to be releasing from the dredge bucket onto the receiving barge prior to placement into the containers (onto the portion of the barge deck that was not within the dewatering area or in the containers), with the potential to discharge to the waterway from scuppers without being treated.</p>	<p>The implementation of additional BMPs were necessary to address this issue, which should be applied in future dredging projects as appropriate. Future projects should also consider the configuration of the remedial action area to minimize the distance the bucket needs to travel to reach the receiving barge deck/containers.</p> <p>Additional BMPs implemented during this remedial action including and per USEPA's direction included dewatering the bucket nearer to the water surface and for a long duration prior to transporting the dredged materials to the receiving barge for containerization. This BMP minimized the water release from the bucket onto the barge deck, and also minimized the turbidity in the remedial action area caused during the movement of the bucket to the receiving barge.</p> <p>Additionally, a straw wattle was placed between the containers and the only scupper present where water could discharge into the waterway (as shown in Appendix A, Photograph 10), which proved to be effective at containing the minimal amount of water released to the deck of the receiving barge.</p>
<p>As discussed in detail in Section 3.3.2, a turbidity plume was observed upon commencement of passive dewatering on February 6, 2015, below the western discharge point/scupper of the dewatering system. Though this plume <u>did not</u> result in a water quality exceedance, turbid discharge to the waterway should be minimized as possible.</p>	<p>As described in the February 11, 2015 memorandum submitted to USEPA (Appendix C), a number of components of the treatment system needed to be modified to prevent turbidity discharge. These BMPs are further discussed in Section 3.3.2, and include additional filtration materials, further settling of the dredge materials, using a lower-speed pump, and consistent monitoring of the pump (both intake and flow rate).</p> <p>The Contractor should adaptively manage the water treatment system, being prepared to implement additional BMPs as necessary throughout the duration of the remedial action.</p>
<p>The water quality instrument failure resulted in the inability to collect water quality measurements on the final day of capping.</p>	<p>Instrumentation failure scenarios should be discussed with the Contractors conducting the monitoring so that reasonable responses can be determined in advance. USEPA plans to hold such briefings for subsequent projects.</p>

RAWP Deviations & Adaptive Management Items	Lessons Learned
The water quality monitoring reporting forms need a specific space for the sampler to describe activity and duration of an ongoing activity prior to monitoring, including the time and height of the closest low or high tide.	Future water quality monitoring reporting forms should be designed to include specific spaces for the additional information required.

## 8.0 Remedial Action Construction Summary

The purpose of this document was to describe the remedial activities implemented to address the area in the vicinity of the MMB contaminated during the bridge rehabilitation conducted between 2011 and 2013. To address all of the contaminated sediments, an area of approximately 3,000 square feet was dredged to a depth of a minimum of 6 inches, and capped to the pre-remedial action surface. The implemented remedial action documented in this RACR was completed on February 14, 2015, and achieved the objectives set forth in the USEPA-approved RAWP. Additionally, all post-remedial action surface sediment samples comply with Thea Foss SQOs. Both the chemical analysis of surface sediments and the hydrographic survey, which was conducted post-remedial action will serve as a baseline for comparisons in future OMMP monitoring. The next OMMP monitoring event is to be conducted by the City in Year 10 (2016) and will include one surface sediment sampling location within the remedial action area. This capped area will also be included in the OMMP subtidal hydrographic survey areas.

The MMB is located within the boundaries of the Commencement Bay Nearshore/Tideflats Superfund Site (USEPA 1989). Because the implemented remedy achieved its objectives, no further Superfund response or action is needed to protect human health and the environment. Future USEPA review of the remedial action will be included during the Thea Foss and Wheeler-Osgood Waterways and Commencement Bay 5-year review process conducted for the Commencement Bay Nearshore/Tideflats Superfund Site.

## 9.0 References

- City of Tacoma. 2006. *Institutional Controls Plan. Thea Foss and Wheeler-Osgood Waterways Remediation Project*. Prepared for U.S. Environmental Protection Agency. September.
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- \_\_\_\_\_. 2011b. *Murray Morgan Bridge Rehabilitation: Pre-construction Sediment Sampling Results Memorandum*. Prepared for Tom Rutherford, City of Tacoma. 14 June.
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- \_\_\_\_\_. 2014. Letter from USEPA to City of Tacoma re: Cleanup of Contamination to Thea Foss Waterway from Rehabilitation Work on the Murray Morgan Bridge. 8 August.
- \_\_\_\_\_. 2015a. Letter from USEPA to City of Tacoma re: Approval of Work Plan for the Murray Morgan Bridge Remedial Action. 7 January.
- \_\_\_\_\_. 2015b. Clean Water Act Section 401 Substantive Water Quality Requirements for the Murray Morgan Bridge Remedial Action Memorandum.



# **Murray Morgan Bridge Remedial Action**

## **Remedial Action Construction Report**

### **Tables**

**Table 5.1**  
**Post-Dredge Surface Sediment Sample (0–10 cm) Results**

Location			MMB-PD-1		MMB-PD-2			
Sample ID			MMB-PD-1		MMB-PD-2		MMB-PD-2-DUP	
Sample Type			Primary		Primary		Field Duplicate	
Sample Date			2/7/2015	Enrichment Ratio	2/7/2015	Enrichment Ratio	2/7/2015	Enrichment Ratio
Sample Depth			0–10 cm		0–10 cm		0–10 cm	
Analyte	Units	SQOs						
<b>Conventionals</b>								
Total Organic Carbon	%	NC	3.7	NA	1.2	NA	1.32	NA
Total Solides	%		56.4	NA	64.3	NA	65.2	NA
<b>Metals (USEPA 6020A and 7471)</b>								
Copper	mg/kg	390	106	0.27	45.5	0.12	58	0.15
Lead	mg/kg	450	646 J	1.44	60.9	0.14	71.4	0.16
Mercury	mg/kg	0.59	1.07	1.81	0.398	0.67	0.384 U	0.65
Zinc	mg/kg	410	220	0.54	92.4	0.23	105	0.26

Note:

**RED** Indicates that the detected concentration exceeds the SQO.

Abbreviations:

cm Centimeter

mg/kg Milligrams per kilogram

NA Not applicable

NC No SQO criterion

SQO Sediment Quality Objective

Qualifiers:

J Analyte was detected, analyte is considered an estimate.

U Analyte not detected at given reporting limit.

Table 5.2  
Comparison of Post-Dredge Surface Sediment Sample Results to 2013 MMB Post-Construction Surface Sediment Sample Results

Location			MMB-PD-1		MMB-PD-2		MMB-PD-2		MMB-6		MMB-6		MMB-6	
Sample ID			MMB-PD-1		MMB-PD-2		MMB-PD-2-DUP		MMB-6-050113		MMB-6-V2-122013		MMB-6-V3-122013	
Sample Event			2015 Post-Dredge Sediment Sampling						2013 MMB Post-Construction Sediment Sampling					
Sample Type			Primary		Primary		Field Duplicate		Primary		Primary		Primary	
Sample Date			2/7/2015	Enrichment	2/7/2015	Enrichment	2/7/2015	Enrichment	5/1/2013	Enrichment	12/20/2013	Enrichment	12/20/2013	Enrichment
Sample Depth			0–10 cm	Ratio	0–10 cm	Ratio	0–10 cm	Ratio	0–10 cm	Ratio	0–10 cm	Ratio	0–10 cm	Ratio
Analyte	Units	SQO												
Conventionals														
Total Organic Carbon	%	NC	3.70	NA	1.20	NA	1.32	NA	2.58	NA	1.13	NA	2.30	NA
Total Solids	%	NC	56.4	NA	64.3	NA	65.2	NA	56.3	NA	70.6	NA	57.9	NA
Metals														
Copper	mg/kg	390	106	0.27	45.5	0.12	58	0.15	116	0.30	826	2.12	115	0.29
Lead	mg/kg	450	646 J	1.44	60.9	0.14	71.4	0.16	723	1.61	2,690	5.98	822	1.83
Mercury	mg/kg	0.59	1.07	1.81	0.398	0.67	0.384 U	NA	0.227 U	NA	0.0407	0.07	0.137	0.23
Zinc	mg/kg	410	220	0.54	92.4	0.23	105	0.26	260	0.63	781	1.90	268	0.65

Note:  
RED Indicates that the detected concentration exceeds the SQO.

Abbreviations:  
cm Centimeters  
mg/kg Milligrams per kilogram  
MMB Murray Morgan Bridge  
NA Not applicable  
NC No SQO criterion  
SQO Sediment Quality Objective

Qualifiers:  
J The analyte was analyzed for and positively identified, but the associated numerical value is an estimated quantity  
U The analyte was analyzed for and not detected at the given reporting limit.

Table 5.3  
Post-Remedial Action Surface Sediment Sample (0–10 cm) Results

Location			MMB-PC-1				MMB-PC-2		MMB-6					
Sample ID			MMB-PC-1		MMB-PC-1-DUP		MMB-PC-2		MMB-6-D1-021415		MMB-6-D7-021415		MMB-6-V1-021415	
Sample Type			Primary		Field Duplicate		Primary		Primary		Primary		Primary	
Sample Date			2/14/2015	Enrichment	2/14/2015	Enrichment	2/14/2015	Enrichment	2/14/2015	Enrichment	2/14/2015	Enrichment	2/14/2015	Enrichment
Sample Depth			0–10 cm	Ratio	0–10 cm	Ratio	0–10 cm	Ratio	0–10 cm	Ratio	0–10 cm	Ratio	0–10 cm	Ratio
Analyte	Units	SQO												
Conventionals														
Total Organic Carbon	%	NC	1.05	NA	1.51	NA	1.26	NA	1.94	NA	2.18	NA	1.78	NA
Total Solids		NC	97	NA	96.6	NA	95.9	NA	55	NA	51.3	NA	58.3	NA
Metals (USEPA 6020A and 7471)														
Copper	mg/kg	390	9.28	0.024	7	0.018	10.7	0.027	84.1	0.22	83.7	0.21	70.1	0.18
Lead	mg/kg	450	0.962	0.002	0.832	0.002	1.31	0.003	81.3	0.18	109	0.24	73.1	0.16
Mercury	mg/kg	0.59	0.248 U	NA	0.249 U	NA	0.256 U	NA	0.405 U	NA	0.487 U	NA	0.383 U	NA
Zinc	mg/kg	410	17.2	0.042	14.9	0.036	22.5	0.055	138	0.34	127	0.31	138	0.34
Grain Size (ASTM D422)														
GS >76.2 mm	%	NC	0 U	NA	0 U	NA	0 U	NA	0 U	NA	0 U	NA	0 U	NA
GS 50.8–76.2 mm	%	NC	0 U	NA	0 U	NA	0 U	NA	0 U	NA	0 U	NA	0 U	NA
GS 38.1–50.8 mm	%	NC	0 U	NA	0 U	NA	0 U	NA	0 U	NA	0 U	NA	0 U	NA
GS 25.4–38.1 mm	%	NC	0 U	NA	0 U	NA	0 U	NA	0 U	NA	0 U	NA	0 U	NA
GS 19–25.4 mm	%	NC	0 U	NA	0 U	NA	0 U	NA	0 U	NA	0 U	NA	0 U	NA
GS 9525–19050 µm	%	NC	0 U	NA	0 U	NA	0 U	NA	0 U	NA	0 U	NA	0 U	NA
GS 4750–9525 µm	%	NC	20	NA	21.7	NA	23.2	NA	0 U	NA	0.132	NA	0.0401	NA
GS 2000–4750 µm	%	NC	47	NA	46.1	NA	44.4	NA	0.0223	NA	1.6	NA	0.3	NA
GS 850–2000 µm	%	NC	15.9	NA	13.3	NA	15	NA	1.59	NA	4.21	NA	1.08	NA
GS 425–850 µm	%	NC	11.7	NA	11.8	NA	11.7	NA	5.79	NA	7.76	NA	6.31	NA
GS 250–425 µm	%	NC	4.1	NA	4.13	NA	4.28	NA	17.9	NA	52.1	NA	36.2	NA
GS 106–250 µm	%	NC	1.25	NA	1.13	NA	1.13	NA	34.7	NA	27.9	NA	30.7	NA
GS 62.5–106 µm	%	NC	0.0793	NA	0.0517	NA	0.0483	NA	10.4	NA	4.44	NA	8.51	NA
GS 45–72.5 µm	%	NC	0.0348	NA	0.0306	NA	0.0242	NA	14.2	NA	1.32	NA	11.1	NA
GS 34–45 µm	%	NC	0.00971	NA	0.00549	NA	0.00624	NA	5.44	NA	0.158	NA	3.81	NA
GS <34 µm	%	NC	0.00809	NA	0.00392	NA	0.0125	NA	9.8	NA	0.0521	NA	1.97	NA

Abbreviations:

- cm Centimeters
- µm Micrometer
- mg/kg Milligrams per kilogram
- mm Millimeter
- NA Not applicable
- NC No SQO criterion
- SQO Sediment Quality Objective

Qualifier:

- U Analyte not detected at given reporting limit.

Table 5.4 Comparison of Post-Remedial Action Surface Sediment Sample Results to 2013 and 2014 MMB Post-Construction Surface Sediment Sample Results														
Location			MMB-6		MMB-6		MMB-6		MMB-6		MMB-6		MMB-6	
Sample ID			MMB-6-V1-021415		MMB-6-V1-122013		MMB-6-D1-021415		MMB-6-D1-042214		MMB-6-D7-021415		MMB-6-D7-042214	
Sample Event			2015 Post-Remedial Action Sediment Sampling		2013 MMB Post- Construction Sediment Sampling		2015 Post-Remedial Action Sediment Sampling		2014 MMB Post- Construction Sediment Sampling		2015 Post-Remedial Action Sediment Sampling		2014 MMB Post- Construction Sediment Sampling	
Sample Type			Primary		Primary		Primary		Primary		Primary		Primary	
Sample Date			2/14/2015	Enrichment	12/20/2013	Enrichment	2/14/2015	Enrichment	4/22/2014	Enrichment	2/14/2015	Enrichment	4/22/2014	Enrichment
Sample Depth			0–10 cm	Ratio	0–10 cm	Ratio	0–10 cm	Ratio	0–10 cm	Ratio	0–10 cm	Ratio	0–10 cm	Ratio
Analyte	Units	SQO												
Conventionals														
Total Organic Carbon	mg/kg	NC	1.78	NA	22.5	NA	1.94	NA	2.06 J	NA	2.18	NA	1.99 J	NA
Total Solids	%	NC	58.3	NA	49.5	NA	55	NA	55.2	NA	51.3	NA	63.2	NA
Metals														
Copper	mg/kg	390	70.1	0.18	97.5	0.25	84.1	0.22	89.6	0.23	83.7	0.21	70.2	0.18
Lead	mg/kg	450	73	0.16	85.4	0.19	81.3	0.18	116 J	0.26	109	0.24	72.6 J	0.16
Mercury	mg/kg	0.59	0.383 U	NA	0.257	0.44	0.405 U	NA	0.4	0.68	0.487 U	NA	0.272	0.46
Zinc	mg/kg	410	138	0.34	141	0.34	138	0.34	113	0.28	127	0.31	106	0.26

Abbreviations:

- cm Centimeters
- mg/kg Milligrams per kilogram
- MMB Murray Morgan Bridge
- NA Not applicable
- NC No SQO criterion
- SQO Sediment Quality Objective

Qualifiers:

- J The analyte was analyzed for and positively identified, but the associated numerical value is an estimated quantity.
- U The analyte was analyzed for and not detected at the given reporting limit.

# **Murray Morgan Bridge Remedial Action**

## **Remedial Action Construction Report**

### **Figures**



Note:  
· Imagery provided by Esri.









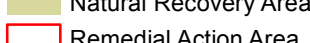
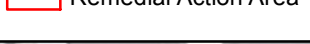
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**Remedial Action Construction Report  
Murray Morgan Bridge Remedial Action  
Tacoma, Washington**

Figure 1.1  
Site Vicinity Map



## Legend

-  Delineation Surface Sediment Grab Sample Location (0–10 cm)
-  Verification Surface Sediment Grab Sample Location (0–10 cm)
-  Post-Construction Surface Sediment Grab Sample Location (0–10 cm)
-  City of Tacoma Outfall Location
-  Private Outfall Location
-  Navigation Channel
-  Natural Recovery Area
-  Remedial Action Area

## Notes:

- Navigation channel polygon provided by United States Army Corps of Engineers, 2014.
- Outfall locations provided by City of Tacoma. Outfall numbers provided by City of Tacoma or Tacoma-Pierce County Health Department Figure E-1 (1995). Outfalls monitored as part of the City's Thea Foss stormwater monitoring program include Outfalls 230, 235, 237A, 237B, 243, 245, and 254.
- Imagery provided by Esri, 2010.

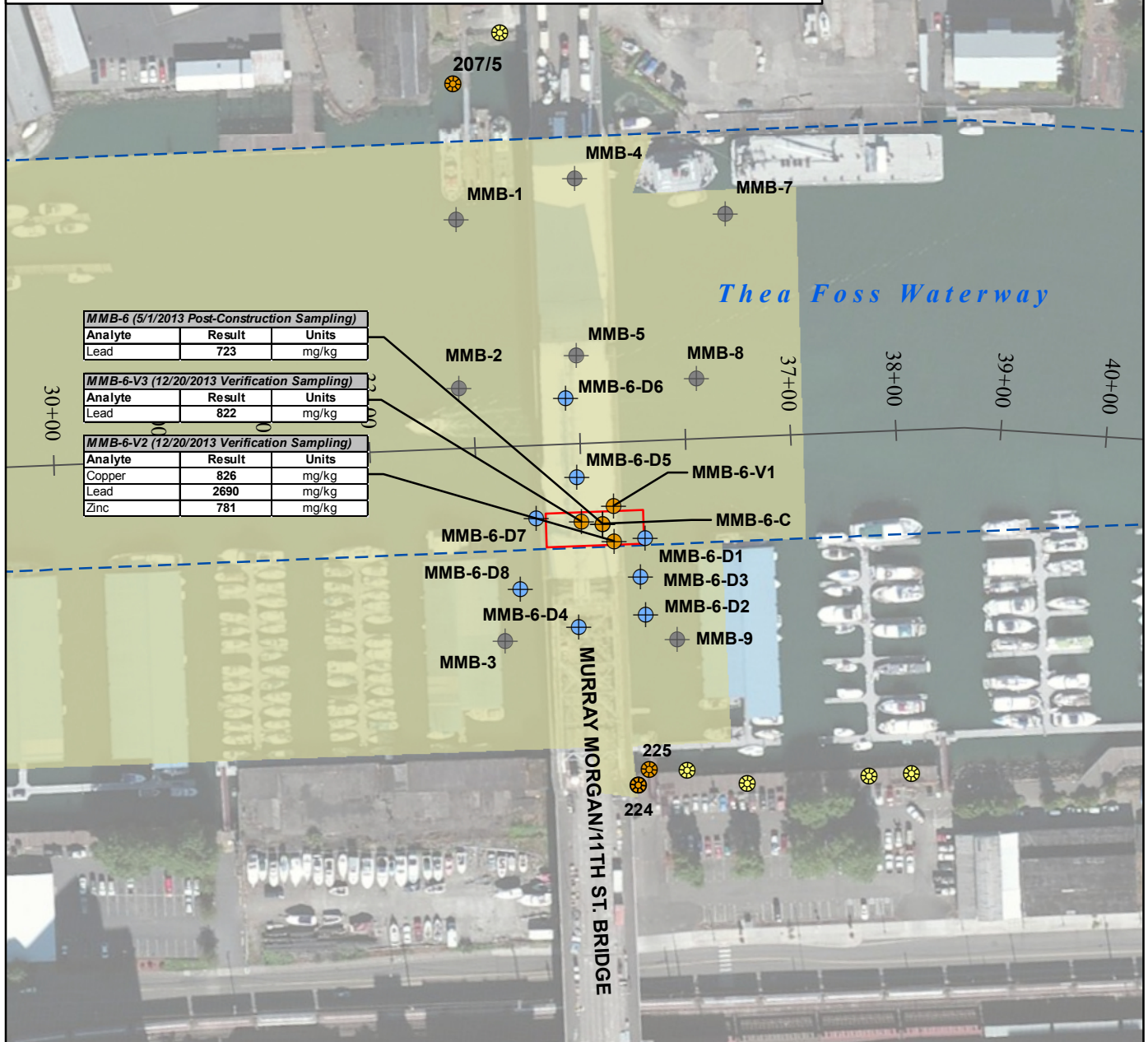
## Abbreviations:

cm = Centimeters  
mg/kg = Milligrams per kilogram

0 75 150



Scale in Feet



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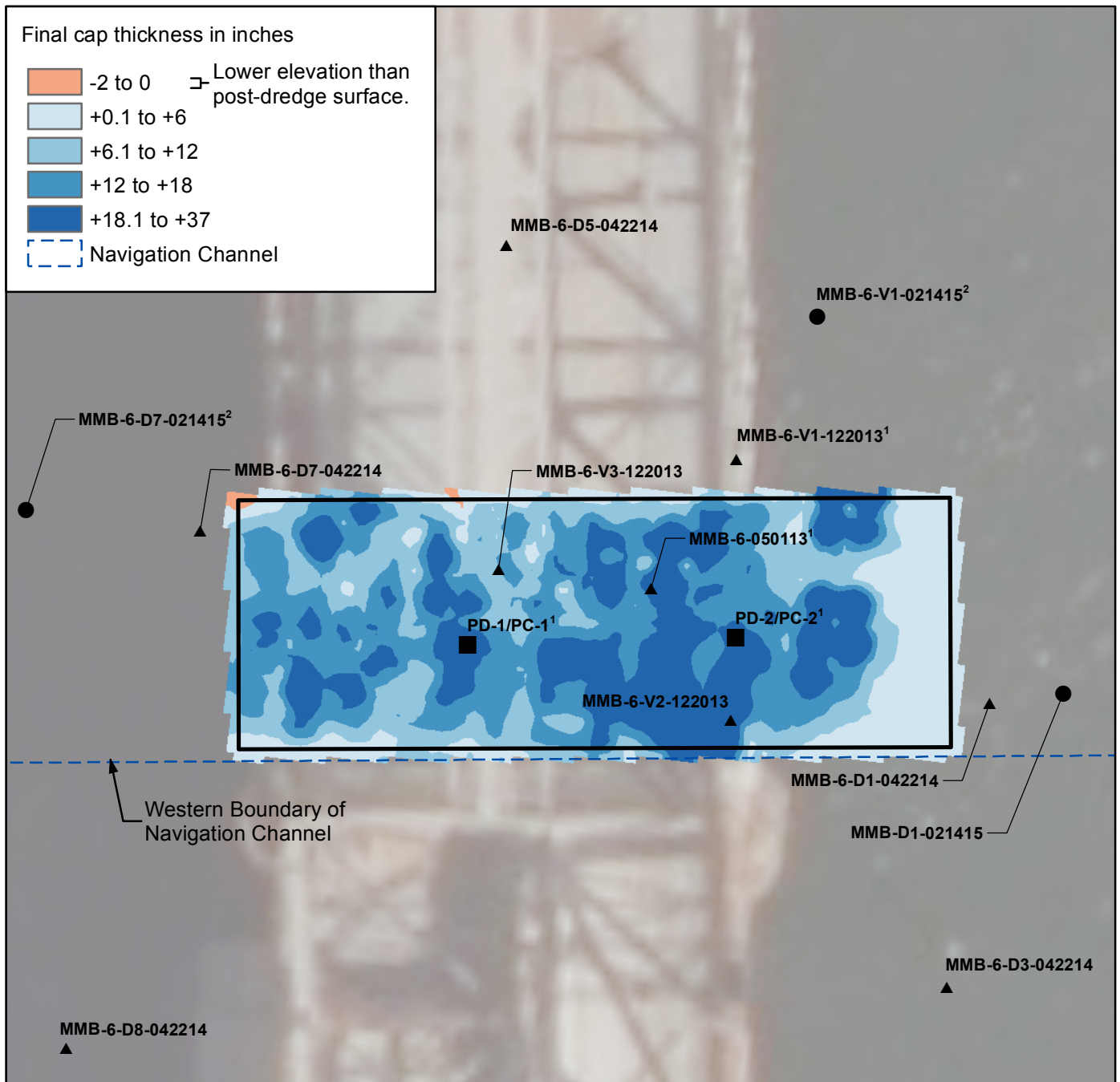
**Figure 1.2  
Site Location and Murray Morgan Bridge  
Post-Construction Surface Sediment  
Sample Locations**

● MMB-6-V1 2013-2014 SAMPLE  
LOCATION AND ID



Figure 2.1  
Remedial Action Area  
Configuration

DWG NAME: E:\Project\clients\Floyd and Snider\Thea Foss\CAD2014\2014FSTheafoss002.dwg  
DATE: 8/4/2015 10:23 AM



## Legend

- ▲ 2013–2014 Murray Morgan Bridge Post-Construction Surface Sediment Sample Locations
- 2015 Post-Dredge and Post-Remedial Action Surface Sediment Sample Locations
- 2015 Post-Remedial Action Surface Sediment Sample Locations
- Remedial Action Area Extent

## Notes:

- 1 Sampling locations are based on physical descriptions of these sampling points because coordinate data collected for these locations were spurious due to global positioning system signal interference caused by the bridge.
- This figure displays the post-remedial action hydrographic survey and lead line soundings subtracted from the post-dredge hydrographic survey and lead line soundings, and displayed using bilinear interpolation. The result is the final cap thickness within the remedial action area.
- Imagery provided by USGS, 2012.

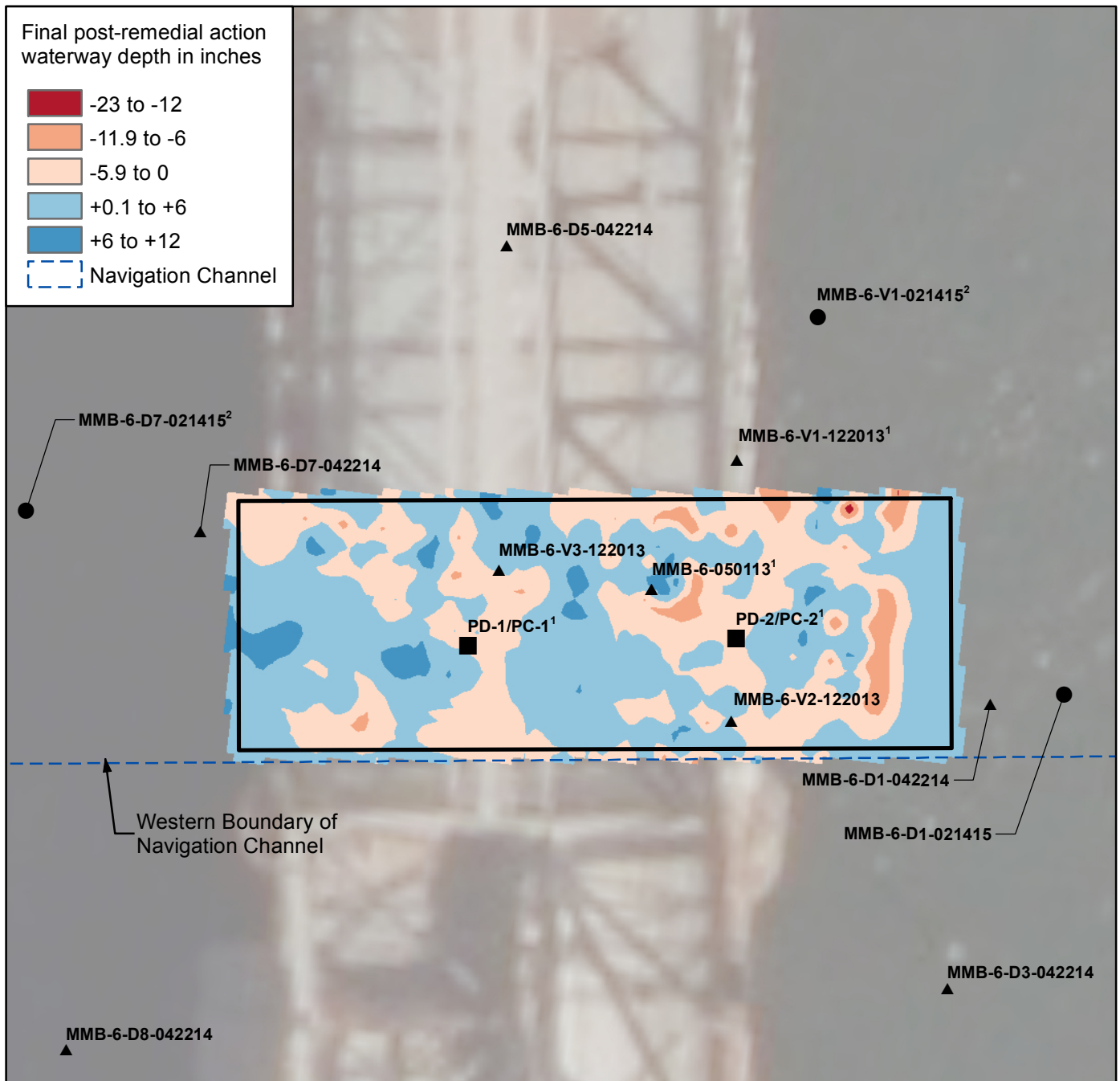


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Murray Morgan Bridge Remedial Action  
Tacoma, Washington**

**Figure 2.2  
Final Cap Thickness**





## Legend

- ▲ 2013–2014 Murray Morgan Bridge Post-Construction Surface Sediment Sample Locations
- 2015 Post-Dredge and Post-Remedial Action Surface Sediment Sample Locations
- 2015 Post-Remedial Action Surface Sediment Sample Locations
- Remedial Action Area Extent

## Notes:

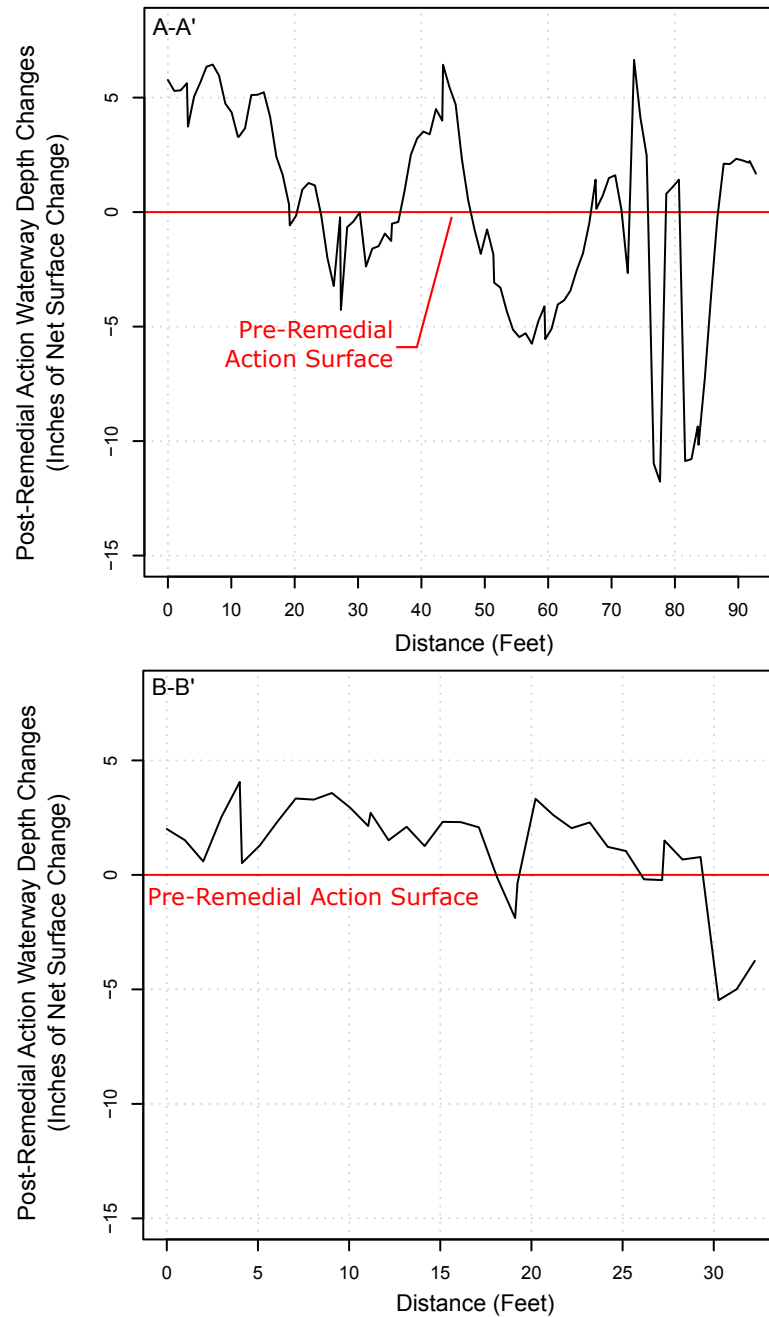
- 1 Sampling locations are based on physical descriptions of these sampling points because coordinate data collected for these locations were spurious due to global positioning system (GPS) signal interference caused by the bridge.
  - 2 This figure displays the post-remedial action hydrographic survey and lead line soundings subtracted from the pre-remedial action hydrographic survey and displayed using bilinear interpolation. The result is the post-remedial action depth changes within the remedial action area.
- Imagery provided by USGS, 2012.



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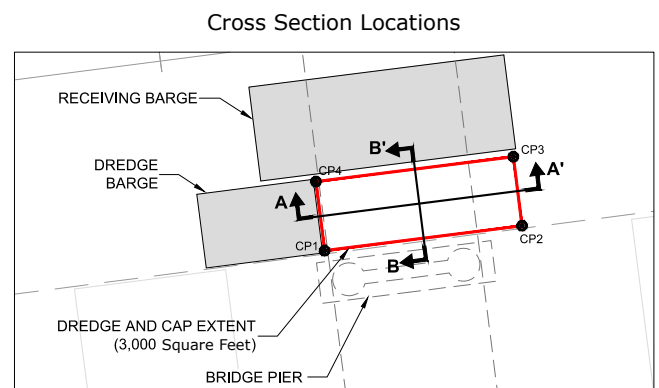
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Murray Morgan Bridge Remedial Action  
Tacoma, Washington**

**Figure 2.3  
Final Post-Remedial Action  
Waterway Depth Changes**

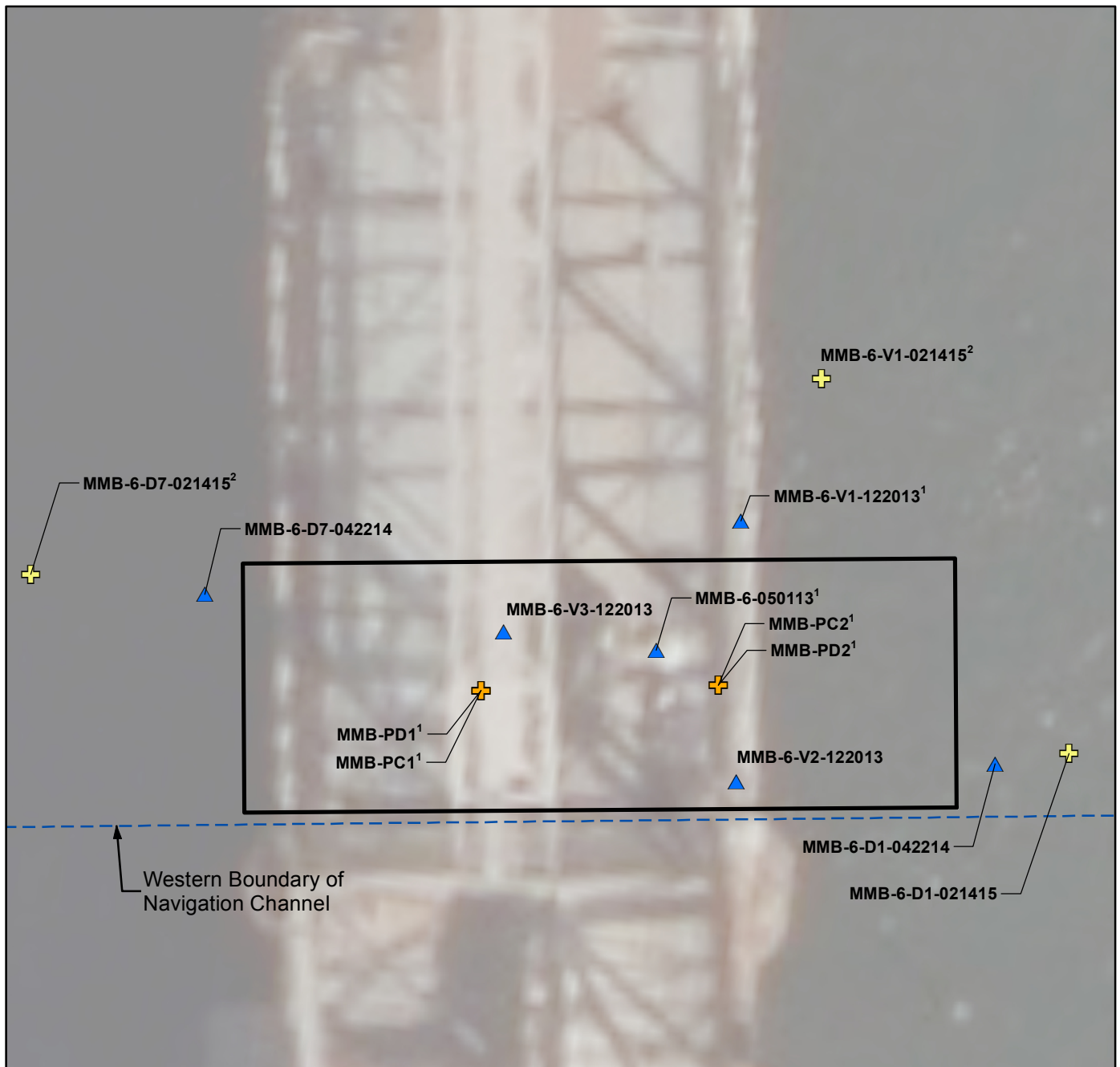


**Note:**

- The cross section shows the difference between the pre- and post-remedial action surfaces along A-A' and B-B' (see locations inset map for cross section locations). This was done by setting the pre-remedial action surface as a baseline and the post-remedial action surface as a line deviating from that baseline. The effect is a net change between surfaces.







## Legend

- ▲ 2013–2014 Murray Morgan Bridge Post-Construction Surface Sediment Sample Locations
- + 2015 Post-Dredge and Post-Remedial Action Surface Sediment Sample Locations
- + 2015 Post-Remedial Action Surface Sediment Sample Locations
- Remedial Action Area Extent
- Navigation Channel

## Notes:

- 1 Sampling locations are based on physical descriptions of these sampling points because coordinate data collected for these locations were spurious due to global positioning system (GPS) signal interference caused by the bridge.
- 2 The post-remedial action sample locations were intended to re-occupy the original Murray Morgan Bridge post-construction sampling locations. However, the post-remedial action locations are approximately 20 feet from the post-construction locations due to GPS signal interference caused by the bridge and field approximation of station locations.
- 3 The last six digits of the sampling location name denotes the sampling date.

· Imagery provided by USGS, 2012.



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Figure 5.1  
Post-Construction, Post-Dredge and  
Post-Remedial Action Surface Sediment  
Sample Locations

**Murray Morgan Bridge Remedial Action**

**Remedial Action**

**Construction Report**

**Appendix A**

**Remedial Action Photographs**

Photo Number	Photo File Number	Description
1	2050011	Tick marks being placed on bridge
2	1000073	Grid marks on barge
3	1000005	Grid system
4	2050095	Tick marks on bucket line
5	2050005	Tide gauge
6	2050104	Dredge bucket dewatering at water surface
7	2050045	Dredge bucket transfer to receiving barge
8	2050061	Placement of dredged materials into container
9	2050116	Inside of container, not overfilled
10	2050056	Straw wattle placement on receiving barge deck
11	2060172	Turbidity plume observed during dewatering
12	2060154	Straw wattles and geotextile added on inside of western wall during dewatering
13	2060156	Straw wattles and geotextile added on outside of western wall during dewatering
14	1000085	Clear discharge during second phase of dewatering
15	1000008	Bucket with chains during capping
16	1000003	Picking up of cap material from receiving barge
17	1000034	Bucket transporting capping material
18	1000042	Contractor directing operator for placement of cap material
19	1000020	Bucket about to deploy capping material
20	1000094	Placement of sand cap material
21	1000037	Lead line soundings measured during capping
22	20150224-122027789	Sediments in container for disposal
23	IMG_1242	Transload of containers to the uplands
24	IMG_1246	Transload of containers to truck for disposal
25	1000024	Water quality monitoring
26	1000099	Water quality monitoring
27	1000112	Carbon amendment observed during water quality monitoring

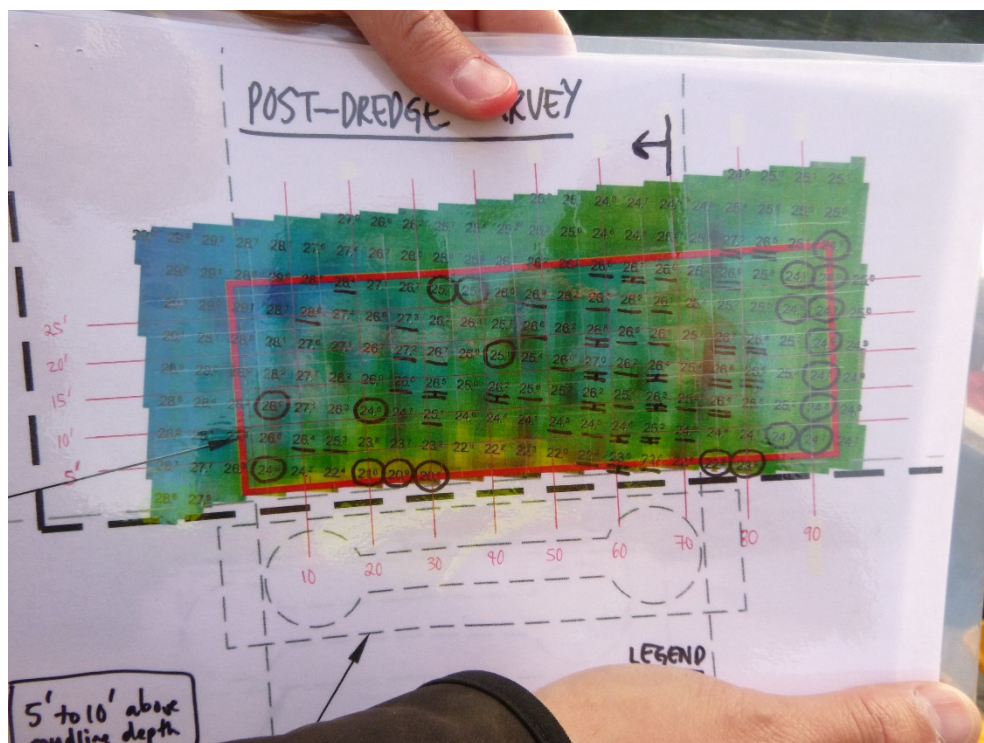


Photograph 1. February 5: Pre-remedial preparation – manual grid on bridge abutment.



Photograph 2. February 5: Pre-remedial preparation – manual grid on dredging barge.



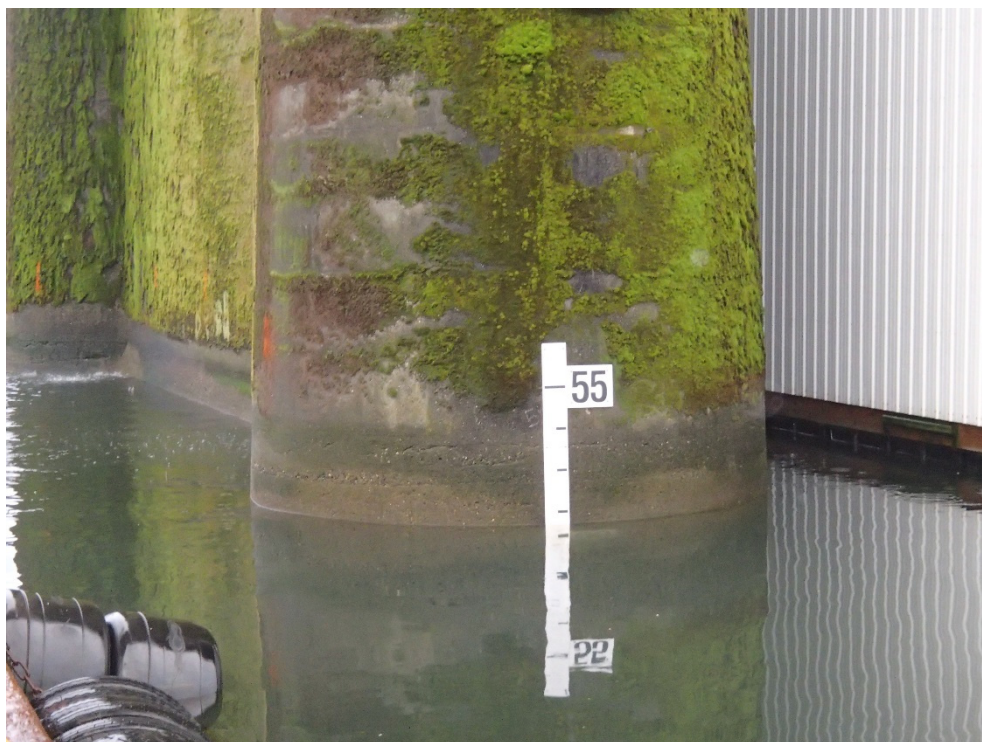


Photograph 3. February 5: 5 by 5 foot manual grid system.



Photograph 4. February 5: Pre-remedial preparation – footage markings on dredge cable.





Photograph 5. February 5: Pre-remedial preparation – tide gage on bridge abutment.



Photograph 6. February 5: Dredge bucket with recovered sediments dewatering at surface of the waterway.





Photograph 7. February 5: Dredge bucket transfer to the receiving barge.



Photograph 8. February 5: Recovered sediments placed by the bucket directly into lined watertight containers on the receiving barge.





Photograph 9. February 5: Lined containers filled to no more than 40 percent capacity to ensure no recovered sediment overflowed back into waterway.



Photograph 10. February 5: Straw wattle placed on the deck between the containers and the scupper to ensure no dredge water discharged to waterway.





Photograph 11. February 6: During dewatering, a small turbidity plume observed at the point of discharge.



Photograph 12. February 6: Modifying the dewatering filtration system to minimize turbid discharge.





Photograph 13. February 6: Modifying the dewatering filtration system to minimize turbid discharge.



Photograph 14. February 13: During dewatering, no turbidity was observed in the waterway originating from the filtration system.





Photograph 15. February 12: Bucket chains used that restricted the opening of the bucket jaws and provided an even rate of release.



Photograph 16. February 12: Transporting sand cap material from the receiving barge.



Photograph 17. February 12: Transfer of sand cap material from the receiving barge.



Photograph 18. February 12: Direction by American for sand cap placement.





Photograph 19. February 12: Placement of sand cap material.



Photograph 20. Placement of sand cap material.

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Appendix A: Remedial Action  
Photographs  
Photographs 19 and 20



Photograph 21. February 14: Lead line measurements taken throughout sand cap placement.



Photograph 22. February 27: Dredge water volume was minimal in the recovered sediments





Photograph 23. February 27: Transload of container to uplands.



Photograph 24. February 27: Placement of container on truck for transport to the rail facility



Photograph 25. Instrumented water quality monitoring conduct throughout the in-water work (dredging, dewatering, and capping).



Photograph 26. February 14: Photograph taken at the mid-point locations and the 150-foot point compliance locations during the capping activities indicated visibly clear water with no observations of turbidity.





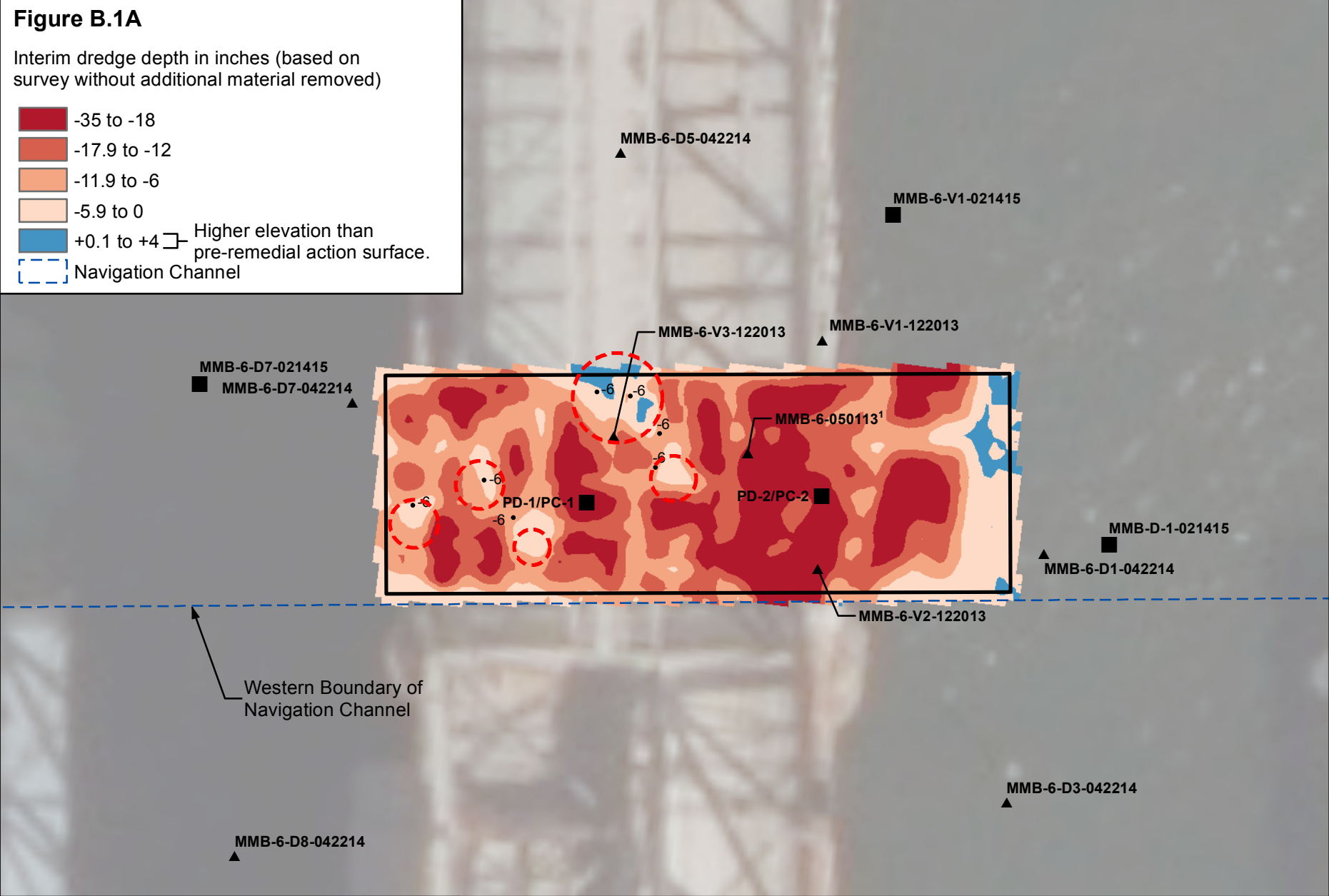
Photograph 27. February 14: Bubbles observed on the water surface at the mid-point 75-foot location, suspected to be residual organic carbon amendment.



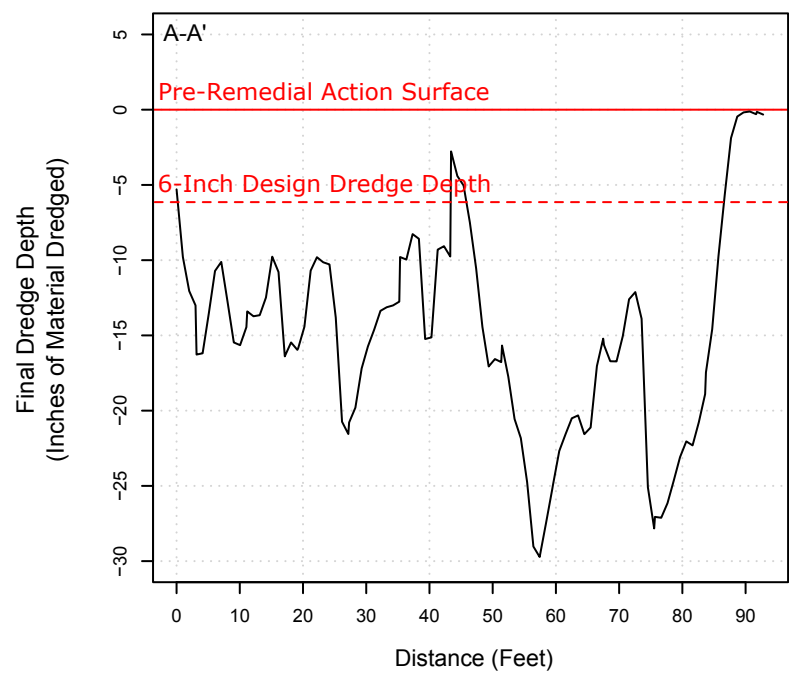
**Murray Morgan Bridge Remedial Action**

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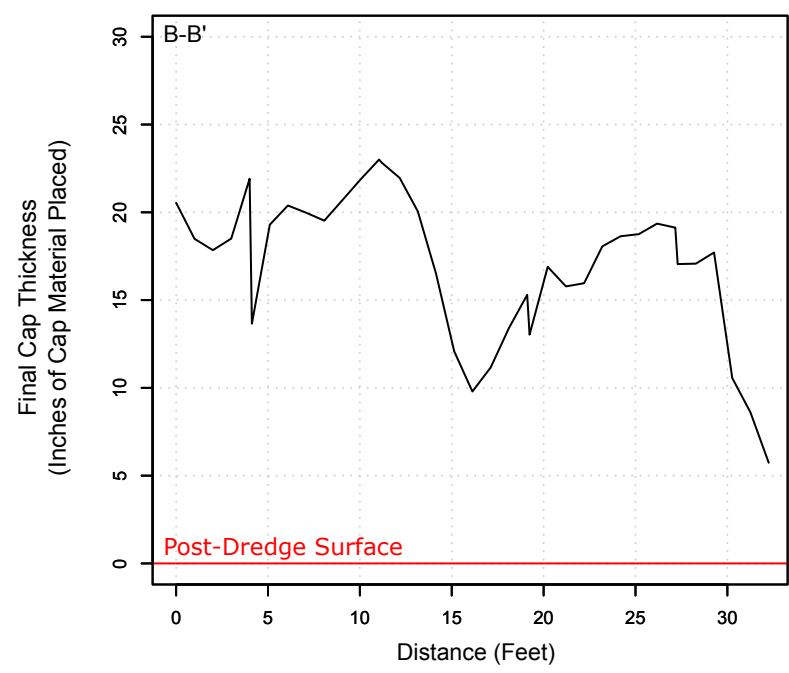
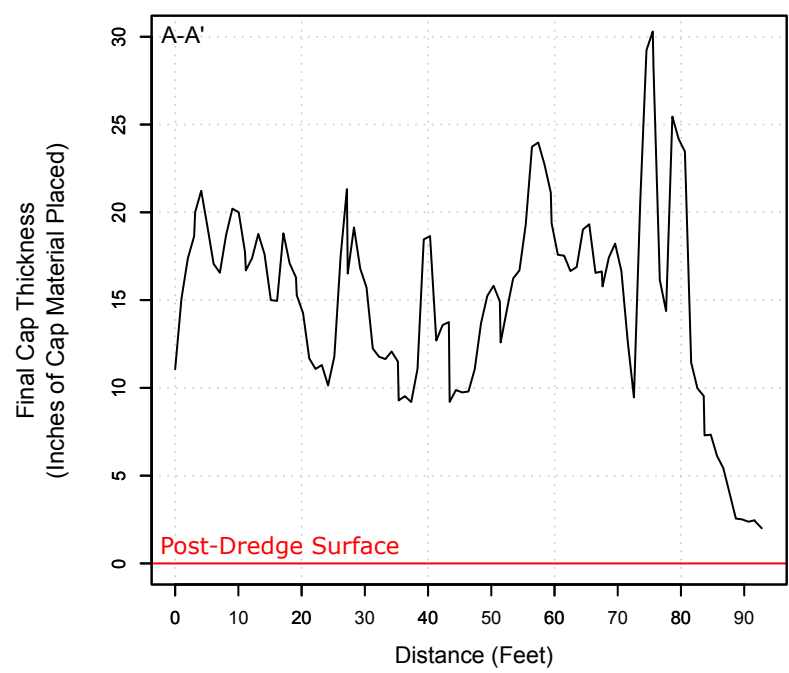
**Appendix B  
Figures Presenting the  
Interim and Final Dredge Depth,  
Cap Thickness, and Post-Remedial Action  
Waterway Depth Changes**



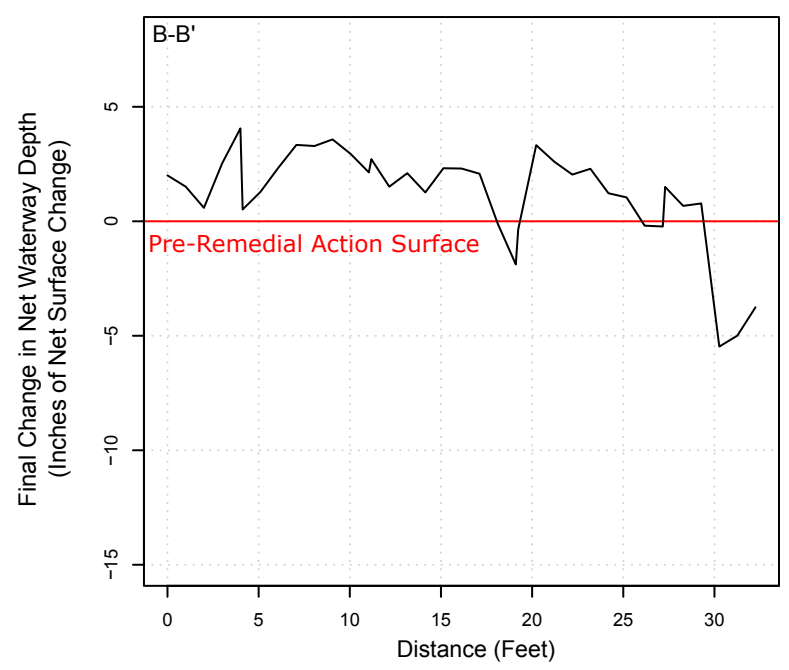
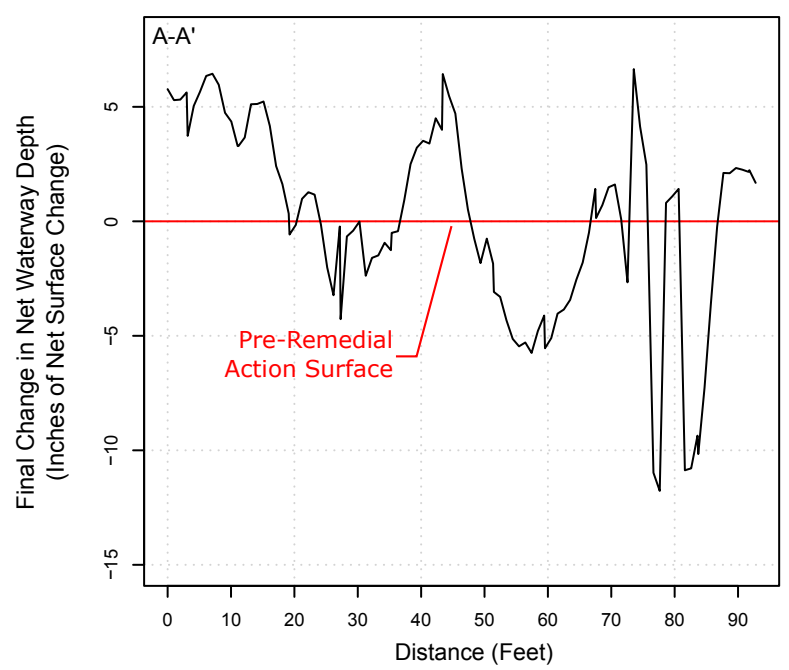
Section 1: Final Dredge Depth



Section 2: Final Cap Thickness

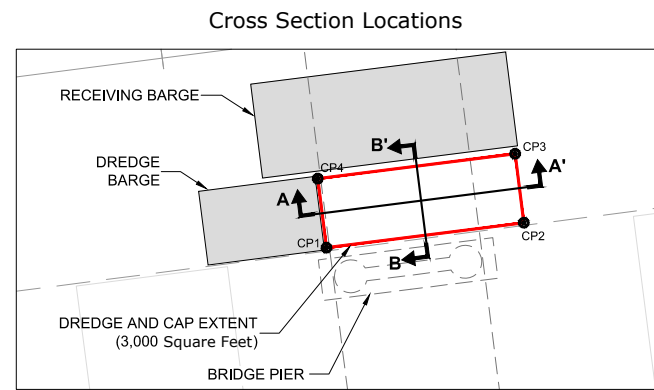


Section 3: Final Change in Net Waterway Depth

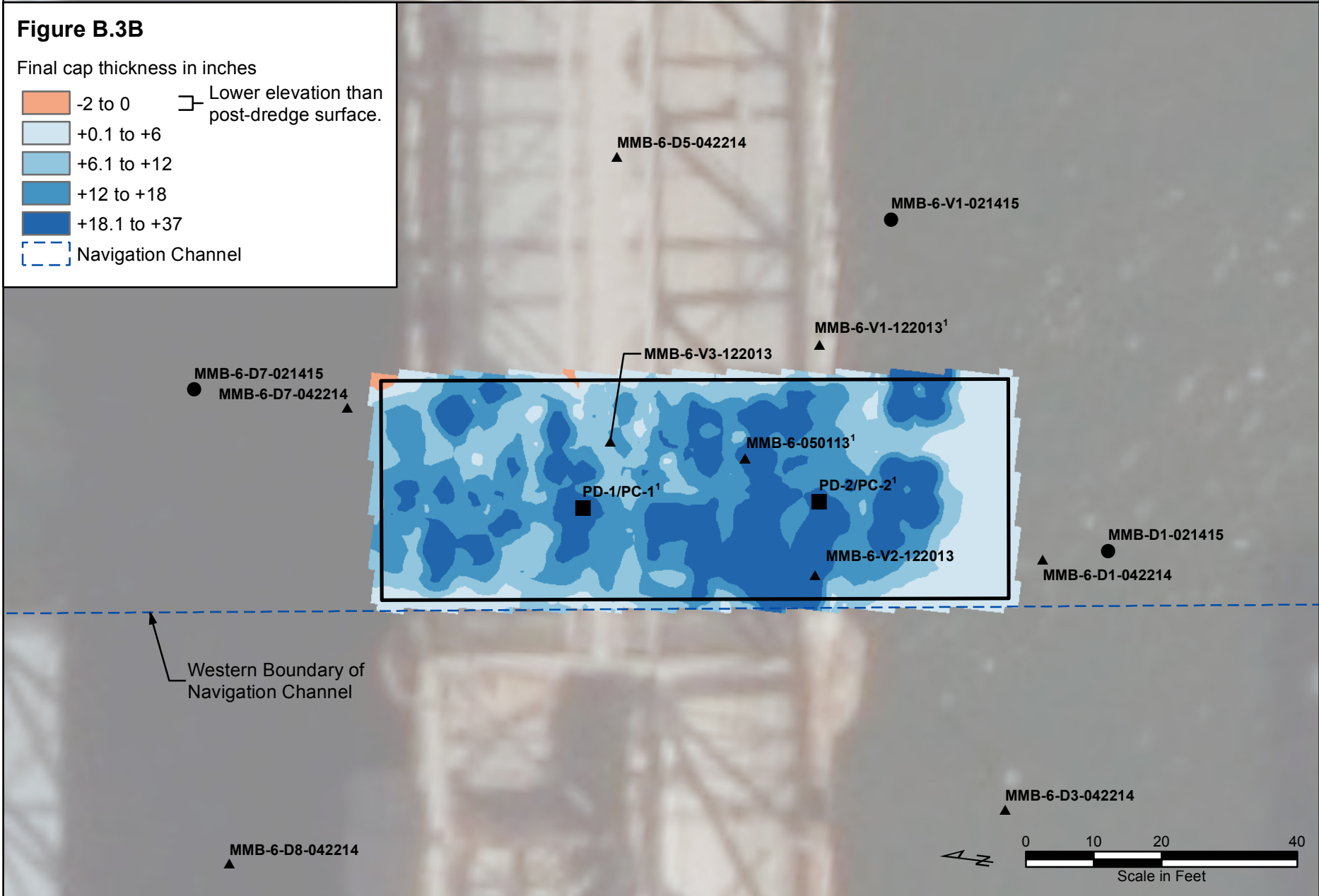
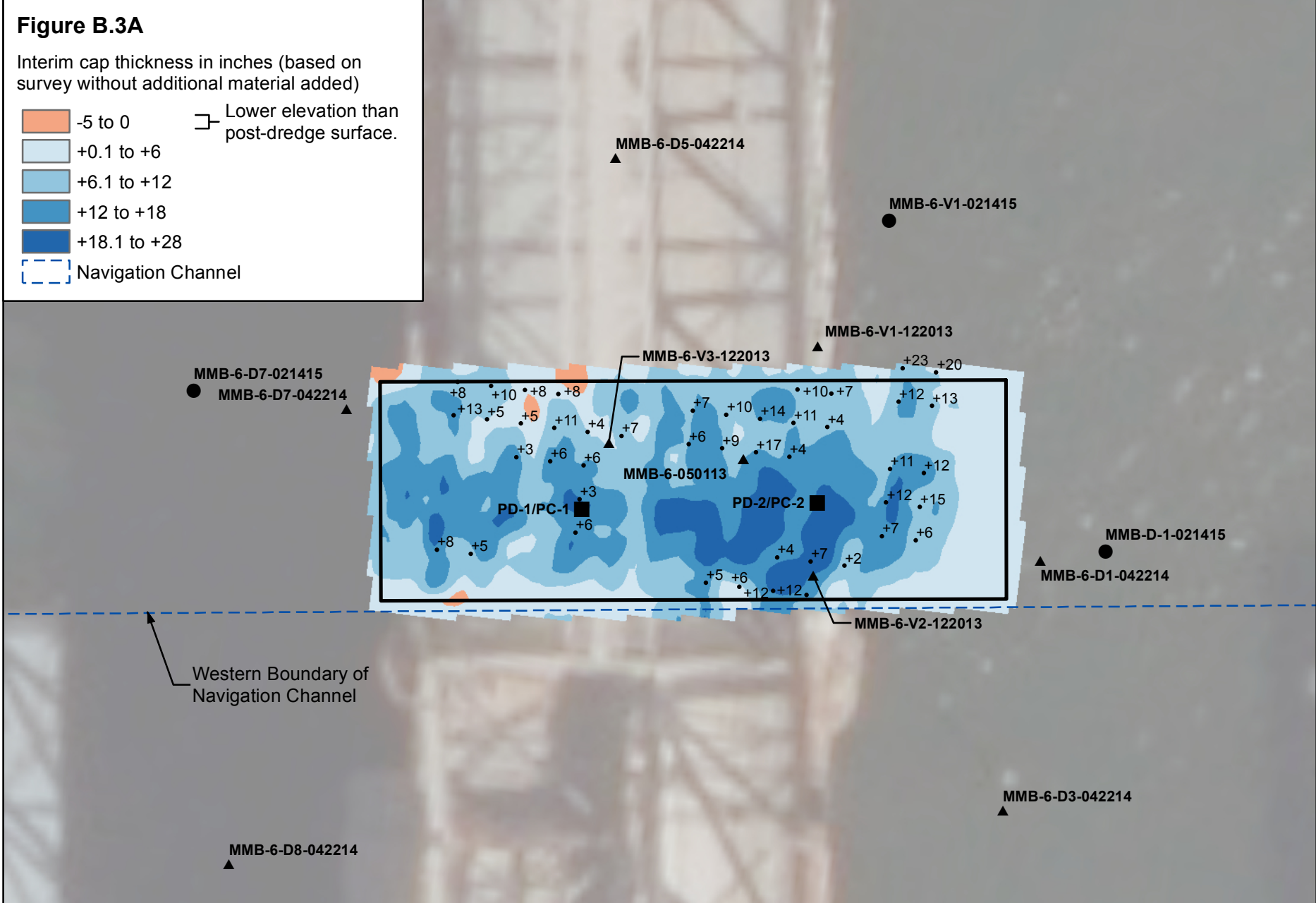


Notes:

- Each cross section shows the difference between two surfaces along A-A' and B-B' shown in the Cross Section Locations inset map. This was done by setting one surface as a baseline and another surface as a line deviating from that baseline. The effect is a figure of net change from one phase of the remedial action to another. The post-dredge surface and post-remedial action surfaces used to generate these cross sections were modifications of the original post-dredge and post-remedial action surveys to account for further dredging and capping that occurred after the bathymetric surveys were complete. These modifications were performed by locating the lead line soundings, buffering those locations to a 5-foot-diameter area, then modifying the survey surfaces using those areas to account for the changes due to further remedial actions. Section 1 shows the net change between the pre-remedial action surface and the modified post-dredge survey. Section 2 shows the net change between the modified post-dredge surface and the modified post-remedial action surface. Section 3 shows the net change between the pre-dredge survey and post-remedial action survey.







**Legend**

2013–2014 Murray Morgan Bridge Post-Construction Surface Sediment Sample Locations

2015 Post-Dredge and Post-Remedial Action Surface Sediment Sample Locations

2015 Post-Remedial Action Surface Sediment Sample Locations

Lead Line Measurement Location and Final Depth Difference (inches)<sup>1</sup>

Remedial Action Area Extent

Notes:

1 Sampling locations are based on physical descriptions of these sampling points because coordinate data collected for these locations were spurious due to global positioning system signal interference caused by the bridge.

For the top frame, comparison of the post-dredge surveys to the post-remedial action survey were subtracted from one another and displayed using bilinear interpolation.

For the bottom frame, before surface subtraction was performed, lead line soundings were integrated into the post-remedial action survey. Each sounding location was buffered to a 5-foot-diameter circle. Those areas were then used to modify the raster to reflect the further capping that occurred after the post-remedial action survey. This modified post-remedial action survey was then subtracted from the post-dredge surface and displayed using bilinear interpolation.

Imagery provided by USGS, 2012.

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Figure B.3

Interim and Final Cap Thickness

I:\GIS\Projects\COT-MMB\MXD\RACR\Figure B.3 Interim and Final Cap Thickness.mxd  
8/4/2015



Figure B.4A

Interim post-remedial action waterway depth changes in inches (based on survey without additional material added)

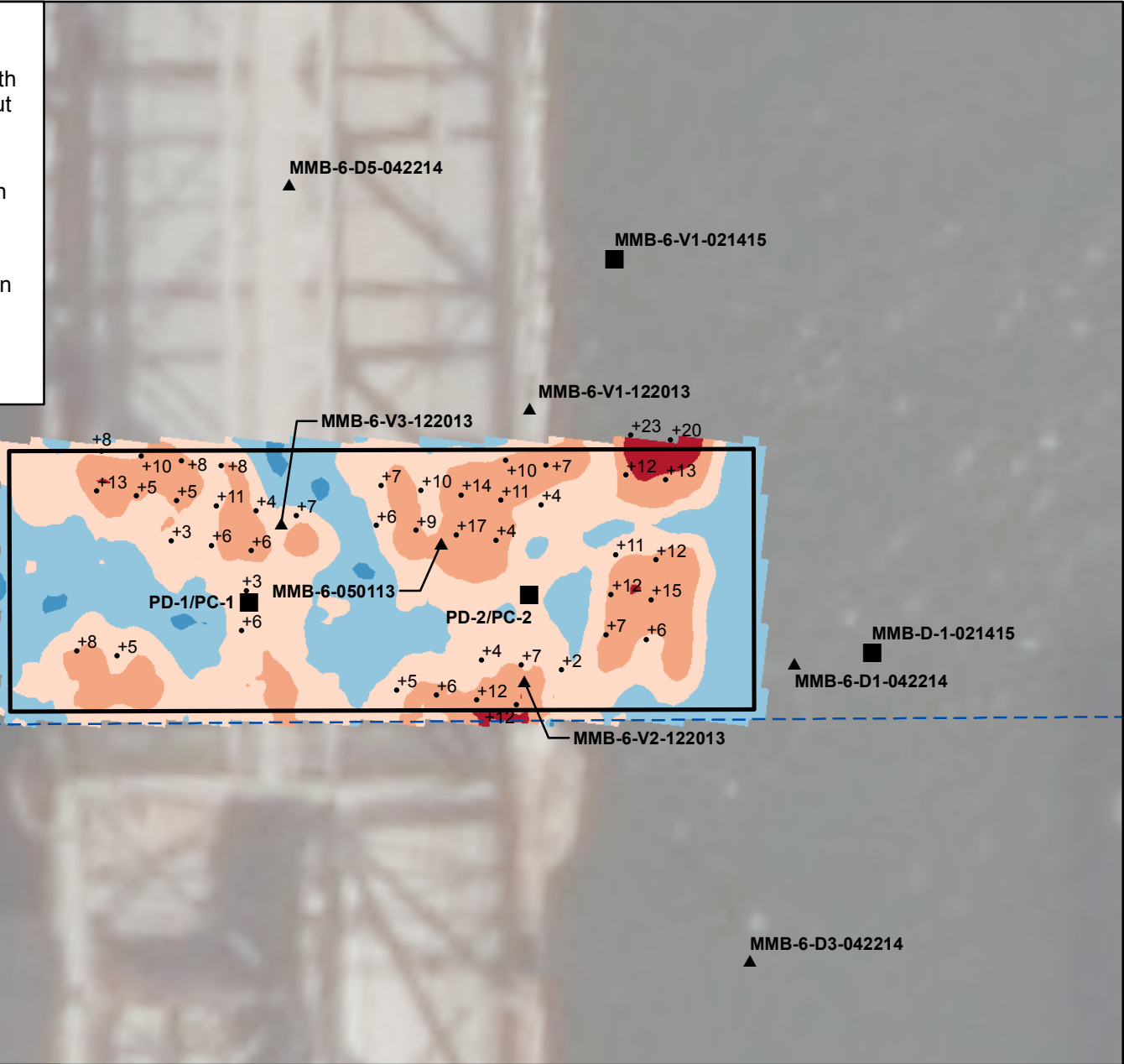
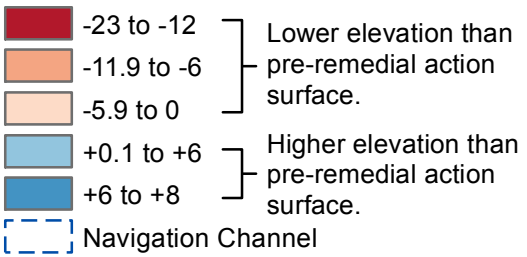
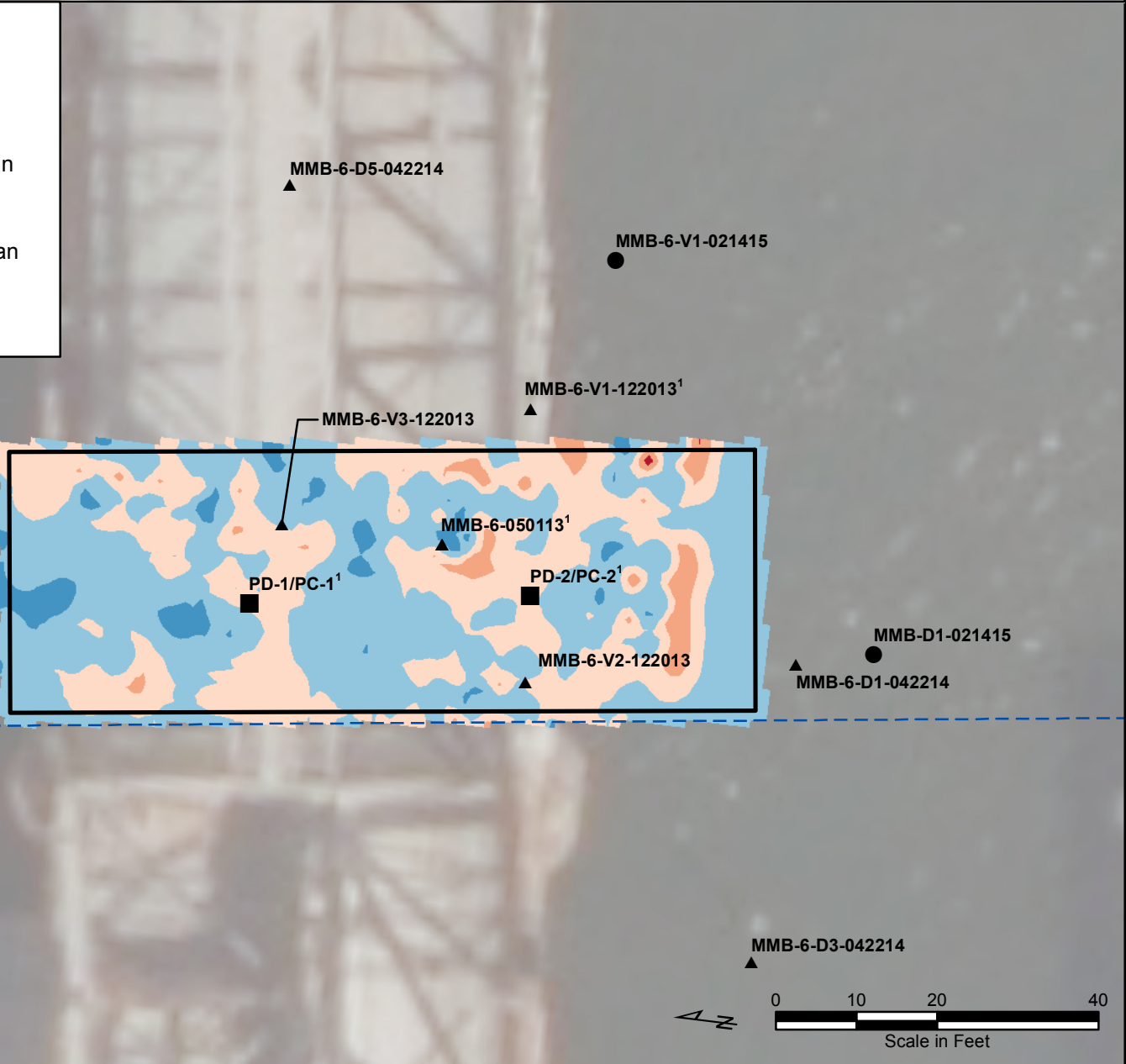
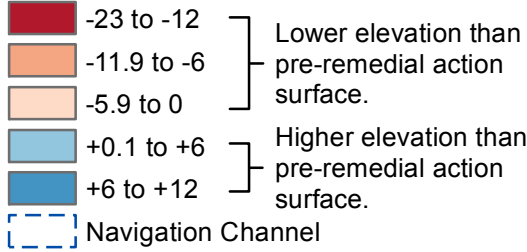


Figure B.4B

Final post-remedial action waterway depth changes in inches



Legend

- 2013–2014 Murray Morgan Bridge Post-Construction Surface Sediment Sample Locations
- 2015 Post-Dredge and Post-Remedial Action Surface Sediment Sample Locations
- 2015 Post-Remedial Action Surface Sediment Sample Locations

- Lead Line Measurement Location and Final Depth Difference (inches)<sup>1</sup>
- Remedial Action Area Extent

Notes:

<sup>1</sup> Sampling locations are based on physical descriptions of these sampling points because coordinate data collected for these locations were spurious due to global positioning system signal interference caused by the bridge.

For the top frame, the pre-remedial action survey and post-remedial action surveys were subtracted from one another and displayed using bilinear interpolation. For the bottom frame, before surface subtraction was performed, lead line soundings were integrated into the post-remedial action survey. Each sounding location was buffered to a 5-foot-diameter circle. Those areas were then used to modify the raster to reflect the further capping that occurred after the post-remedial action survey. This modified post-remedial action survey was then subtracted from the pre-remedial action survey and displayed using bilinear interpolation.

Imagery provided by USGS, 2012.



**Murray Morgan Bridge Remedial Action**

**Remedial Action  
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**Appendix C**

**American Water Quality Monitoring Forms  
and *Actions Taken during Murray Morgan  
Bridge Remedial Action Project Dewatering  
Activities* Technical Memorandum**

Table C.1  
Summary of Water Quality Monitoring Results

Date	Time	Location <sup>1</sup>	Depth (feet)	Turbidity (NTU)	Exceedances/Observations	Reference Photographs
2/5/2015	7:10	A, Reference Location 300' Downstream of Work Area	3	4.2		
2/5/2015	7:11	A, Reference Location 300' Downstream of Work Area	21	3.4		
2/5/2015	7:12	A, Reference Location 300' Downstream of Work Area	39	3.5		
2/5/2015	10:29	B, 150' Compliance Location	3	5.8		
2/5/2015	10:30	B, 150' Compliance Location	19	3.5		
2/5/2015	10:31	B, 150' Compliance Location	34	6.3		
2/5/2015	11:03	C, 150' Upcurrent Location	3	3.3		
2/5/2015	11:03	C, 150' Upcurrent Location	17	3.3		
2/5/2015	11:04	C, 150' Upcurrent Location	30	5.7		
2/5/2015	11:17	D, 75' Midpoint Location	3	6.2		
2/5/2015	11:18	D, 75' Midpoint Location	18	3.6		
2/5/2015	11:19	D, 75' Midpoint Location	33	3.6		
2/5/2015	13:39	E, 150' Compliance Location	3	4.8		
2/5/2015	13:40	E, 150' Compliance Location	16	4.5		
2/5/2015	13:41	E, 150' Compliance Location	29	3.8		
2/6/2015	7:16	A, Reference Location 300' Downstream of Work Area	3	3.2		
2/6/2015	7:17	A, Reference Location 300' Downstream of Work Area	21	3.1		
2/6/2015	7:18	A, Reference Location 300' Downstream of Work Area	39	3.5		
2/6/2015	9:05	B, 150' Upcurrent Location	3	10.3		
2/6/2015	9:06	B, 150' Upcurrent Location	19	10.2		
2/6/2015	9:07	B, 150' Upcurrent Location	35	10.5		
2/6/2015	9:25	C, 75' Midpoint Location Downcurrent	3	13		
2/6/2015	9:26	C, 75' Midpoint Location Downcurrent	20	10.6		
2/6/2015	9:27	C, 75' Midpoint Location Downcurrent	37	12.8		
2/6/2015	9:33	D, 150' Compliance Location	3	14.4	Exceedance of water quality criteria for turbidity (11.2 NTU greater than ambient turbidity). Follow-up measurements indicate no exceedances.	
2/6/2015	9:34	D, 150' Compliance Location	20	10.4		
2/6/2015	9:35	D, 150' Compliance Location	38	12.2		
2/6/2015	9:46	A <sup>2</sup> , Reference Location 300' Downstream of Work Area	3	13		
2/6/2015	9:47	A <sup>2</sup> , Reference Location 300' Downstream of Work Area	21	10.4		
2/6/2015	9:48	A <sup>2</sup> , Reference Location 300' Downstream of Work Area	39	11.7		
2/6/2015	10:15	B, 150' Upcurrent Location	3	10.6		
2/6/2015	10:16	B, 150' Upcurrent Location	18	10.2		
2/6/2015	10:17	B, 150' Upcurrent Location	33	10.6		
2/6/2015	10:32	D, 150' Compliance Location	3	10.7		
2/6/2015	10:33	D, 150' Compliance Location	19	10.3		
2/6/2015	10:34	D, 150' Compliance Location	36	10.7		
2/6/2015	11:03	B, 150' Upcurrent Location	3	10.1		
2/6/2015	11:04	B, 150' Upcurrent Location	18	10.2		
2/6/2015	11:04	B, 150' Upcurrent Location	33	10.5		
2/6/2015	11:09	C, 75' Midpoint Location Downcurrent	3	10.1		
2/6/2015	11:10	C, 75' Midpoint Location Downcurrent	18	10.3		
2/6/2015	11:10	C, 75' Midpoint Location Downcurrent	39	10.8		
2/6/2015	11:12	D, 150' Compliance Location	3	10.4		
2/6/2015	11:13	D, 150' Compliance Location	19	10.3		
2/6/2015	11:14	D, 150' Compliance Location	35	10.9		
2/6/2015	11:17	A <sup>3</sup> , 300' Downstream of Work Area	3	10.5		
2/6/2015	11:18	A <sup>3</sup> , 300' Downstream of Work Area	21	10.5		
2/6/2015	11:19	A <sup>3</sup> , 300' Downstream of Work Area	39	10.9		
2/6/2015	Turbidity measured during dewatering on February 6, 2015 is presented separately; refer to "Water Quality Monitoring during dewatering session on 2/6/15" in this appendix.				A turbidity plume was observed upon commencement of dewatering. It was estimated that the plume was approximately 10 to 20 feet long, 5 to 10 feet wide, and 2 feet deep. No exceedances observed at the 75-foot midpoint location.	Photographs 11 through 13 present the turbidity plume and BMPs implemented.

Table C.1  
Summary of Water Quality Monitoring Results

Date	Time	Location <sup>1</sup>	Depth (feet)	Turbidity (NTU)	Exceedances/Observations	Reference Photographs
2/12/2015	7:01	A, Reference Location 300' Downstream of Work Area	3	-0.8		
2/12/2015	7:02	A, Reference Location 300' Downstream of Work Area	21	-1.1		
2/12/2015	7:02	A, Reference Location 300' Downstream of Work Area	39	-0.9		
2/12/2015	8:44	B, 150' Compliance Location	3	0.8		
2/12/2015	8:45	B, 150' Compliance Location	18	0.7		
2/12/2015	8:46	B, 150' Compliance Location	34	1		
2/12/2015	8:50	C, 75' Midpoint Location Downcurrent	3	0.9		
2/12/2015	8:51	C, 75' Midpoint Location Downcurrent	17	0.8		
2/12/2015	8:52	C, 75' Midpoint Location Downcurrent	32	2.4		
2/12/2015	8:58	D, 150' Upcurrent Location	3	0.7		
2/12/2015	8:58	D, 150' Upcurrent Location	20	1.5		
2/12/2015	8:59	D, 150' Upcurrent Location	37	1		
2/12/2015	10:35	E, 150' During Slack Tide	3	1		
2/12/2015	10:36	E, 150' During Slack Tide	18	2.8		
2/12/2015	10:37	E, 150' During Slack Tide	35	0.9		
2/12/2015	10:42	D, 150' During Slack Tide	3	0.8		
2/12/2015	10:43	D, 150' During Slack Tide	20	0.9		
2/12/2015	10:44	D, 150' During Slack Tide	37	0.3		
2/12/2015	10:51	F, 75' Midpoint Location	3	1		
2/12/2015	10:52	F, 75' Midpoint Location	20	4		
2/12/2015	10:52	F, 75' Midpoint Location	37	7.7		
2/13/2015	7:37	A, 300' North of Work Area	3	0.2		
2/13/2015	7:37	A, 300' North of Work Area	21	0.6		
2/13/2015	7:38	A, 300' North of Work Area	39	0.5		
2/13/2015	8:51	B, 75' Midpoint Location Downcurrent	3	0.3		
2/13/2015	8:52	B, 75' Midpoint Location Downcurrent	17	0.3		
2/13/2015	8:53	B, 75' Midpoint Location Downcurrent	32	0.4		
2/13/2015	8:58	C, 150' Compliance Location Downcurrent	3	0.4		
2/13/2015	8:59	C, 150' Compliance Location Downcurrent	20	0.6		
2/13/2015	9:00	C, 150' Compliance Location Downcurrent	37	3.7		
2/13/2015	9:07	D, 150' Upcurrent Location	3	0.1		
2/13/2015	9:08	D, 150' Upcurrent Location	20	0.5		
2/13/2015	9:08	D, 150' Upcurrent Location	37	0.5		
2/13/2015	11:30	B, 150' During Slack Tide	3	0.6		
2/13/2015	11:31	B, 150' During Slack Tide	17	0.7		
2/13/2015	11:31	B, 150' During Slack Tide	32	2.9		
2/13/2015	11:37	E, 150' During Slack Tide	3	0.7		
2/13/2015	11:37	E, 150' During Slack Tide	20	0.4		
2/13/2015	11:38	E, 150' During Slack Tide	37	0.3		
2/13/2015	11:44	D, 75' Midpoint Location	3	0.7		
2/13/2015	11:45	D, 75' Midpoint Location	20	0		
2/13/2015	11:46	D, 75' Midpoint Location	37	0.3		
2/14/2015	7:21	A, Reference Location 300' Downstream of Work Area	3	0.1		
2/14/2015	7:22	A, Reference Location 300' Downstream of Work Area	19	0.2		
2/14/2015	7:22	A, Reference Location 300' Downstream of Work Area	34	0.4		
2/14/2015 <sup>4</sup>	9:05	B, 150' Compliance Location Downcurrent	Surface	Clear	Water quality meter was not working; therefore, only visual observations were recorded.	Refer to photographs presented in Appendix A for February 14, 2015.
2/14/2015 <sup>4</sup>	9:08	D, 75' Midpoint Location	Surface	Clear		
2/14/2015 <sup>4</sup>	9:10	C, 150' Upcurrent Location	Surface	Clear		
2/14/2015 <sup>4</sup>	10:45	D, 150' Compliance Location Downcurrent	Surface	Clear		
2/14/2015 <sup>4</sup>	10:47	E, 150' Upcurrent Location	Surface	Clear		
2/14/2015 <sup>4</sup>	10:49	C, 75' Midpoint Location	Surface	Clear	At 10:49, 75-foot midpoint location, activated carbon observed on water surface; refer to Section 3.3.3 for details. Water quality meter was not working; therefore, only visual observations were recorded.	Appendix A, Photograph 27.

Notes:

- 1 Locations A through F can be seen on American's field map, "Figure C.2 Water Quality Monitoring Locations," found in this appendix.
- 2 Redo of "Ambient."
- 3 "Ambient" check.
- 4 Visual observations only.

Abbreviations:

- mg/L Milligrams per liter
- NTU Nephelometric turbidity units

**Table C.2**  
**Water Quality Monitoring Instrument Calibration Records**

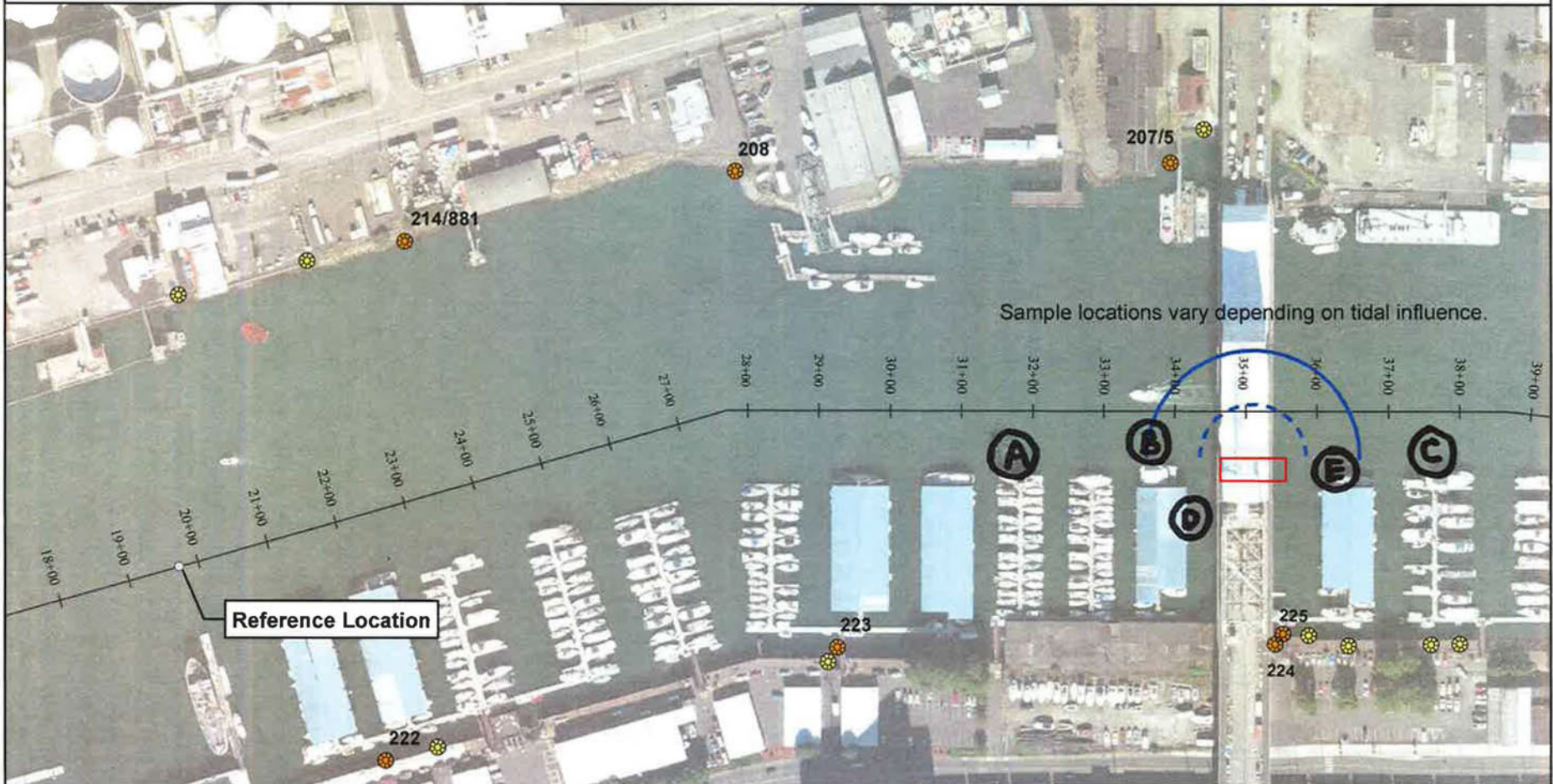
Water Quality Parameter	Turbidity (0 NTU)	Turbidity (100 NTU)	pH 4	pH 7	pH 10	Dissolved Oxygen (%)
<b>Calibration</b>	0.0	100.0	4.00	7.00	10.00	100.0
<b>Date</b>						
2/6/2015	-0.4	92.7	3.98	7.14	10.03	98.2
2/13/2015	-0.5	116.8	3.96	7.08	10.07	102.3
2/14/2015	-1.0	94.3	4.23	6.95	10.68	100

## Legend

- Reference Location  
(approximately 2,250 feet from the remedial activity<sup>1</sup>)
- City of Tacoma Outfall Location
- ⊗ Private Outfall Location
- Mid-Point Monitoring Location  
(75 feet down current of remedial activity)
- Point of Compliance Monitoring Locations  
(150 feet down current and up current of remedial activity)
- Dredge and Cap Extent (3,000 square feet)

### Notes:

- <sup>1</sup> The reference monitoring location is approximately half way between the remedial activity and Commencement Bay or the mouth of the waterway.
- Orthoimage provided by Esri.



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Tacoma, Washington**

**Figure C.2  
Water Quality Monitoring Locations**



Water Quality Monitoring Form  
Murray Morgan Bridge Remedial Action

Location

☐ 150-ft compliance location (down current)

☐ 75-ft midpoint location

☐ 150-ft up current location

☒ Reference location

ABOUT 300' DOWNSTREAM OF WORK AREA

LOCATION (A) : AMBIENT DATA

Date	Time	Depth (surface, midpoint, bottom)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Notes [tidal conditions (slack or strong ebb and/or flood), weather, calibration, etc.]	Name of Personnel Collecting Sample
2/5/15	7:10	3'	4.2	8.26	9.72	7.79	Ebb, RAINY WEATHER	VERNON UY
2/5/15	7:11	21'	3.4	7.48	9.83	7.61	Ebb, RAINY WEATHER	VERNON UY
2/5/15	7:12	39'	3.5	7.07	9.85	7.59	Ebb, RAINY WEATHER	VERNON UY

# Water Quality Monitoring Form

## Murray Morgan Bridge Remedial Action

Location

☒ 150-ft compliance location (down current)

☐ 150-ft up current location

☐ 75-ft midpoint location

☐ Reference location

LOCATION (B)

Date	Time	Depth (surface, midpoint, bottom)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Notes [tidal conditions (slack or strong ebb and/or flood), weather, calibration, etc.]	Name of Personnel Collecting Sample
2/5/15	10:29	3'	5.8	8.25	9.82	7.61	EBB, OVERCAST	VERNON UY
2/5/15	10:30	19'	3.5	7.45	9.84	7.58	EBB, OVERCAST	VERNON UY
2/5/15	10:31	34'	6.3	6.81	9.84	7.56	EBB, OVERCAST	VERNON UY

# Water Quality Monitoring Form

## Murray Morgan Bridge Remedial Action

Location

- ☐ 150-ft compliance location (down current)
- ☐ 75-ft midpoint location

- ☒ 150-ft up current location
- ☐ Reference location

LOCATION (C)

Date	Time	Depth (surface, midpoint, bottom)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Notes [tidal conditions (slack or strong ebb and/or flood), weather, calibration, etc.]	Name of Personnel Collecting Sample
2/5/15	11:03	3'	3.3	7.96	9.83	7.59	EBB , OVERCAST	VERNON UY
2/5/15	11:03	17'	3.3	7.52	9.81	7.59	EBB , OVERCAST	VERNON UY
2/5/15	11:04	30'	5.7	7.25	9.85	7.59	EBB , OVERCAST	VERNON UY

# Water Quality Monitoring Form

## Murray Morgan Bridge Remedial Action

Location

☐ 150-ft compliance location (down current)

☐ 150-ft up current location

☒ 75-ft midpoint location

☐ Reference location

LOCATION

(D)

Date	Time	Depth (surface, midpoint, bottom)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Notes [tidal conditions (slack or strong ebb and/or flood), weather, calibration, etc.]	Name of Personnel Collecting Sample
2/5/15	11:17	3'	6.2	8.28	9.87	7.57	EBB, SHOWERS	VERNON UY
2/5/15	11:18	18'	3.6	7.54	9.83	7.58	EBB, SHOWERS	VERNON UY
2/5/15	11:19	33'	3.6	7.14	9.85	7.58	EBB, SHOWERS	VERNON UY

# Water Quality Monitoring Form

## Murray Morgan Bridge Remedial Action

Location

☒ 150-ft compliance location (down current)

☐ 150-ft up current location

☐ 75-ft midpoint location

☐ Reference location

LOCATION (E)

Date	Time	Depth (surface, midpoint, bottom)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Notes [tidal conditions (slack or strong ebb and/or flood), weather, calibration, etc.]	Name of Personnel Collecting Sample
2/5/15	13:39	3'	4.8	8.04	9.91	7.61	FLOOD, SHOWERS	VERNON UY
2/5/15	13:40	16'	4.5	7.52	9.83	7.60	FLOOD, SHOWERS	VERNON UY
2/5/15	13:41	29'	3.8	7.08	9.85	7.59	FLOOD, SHOWERS	VERNON UY



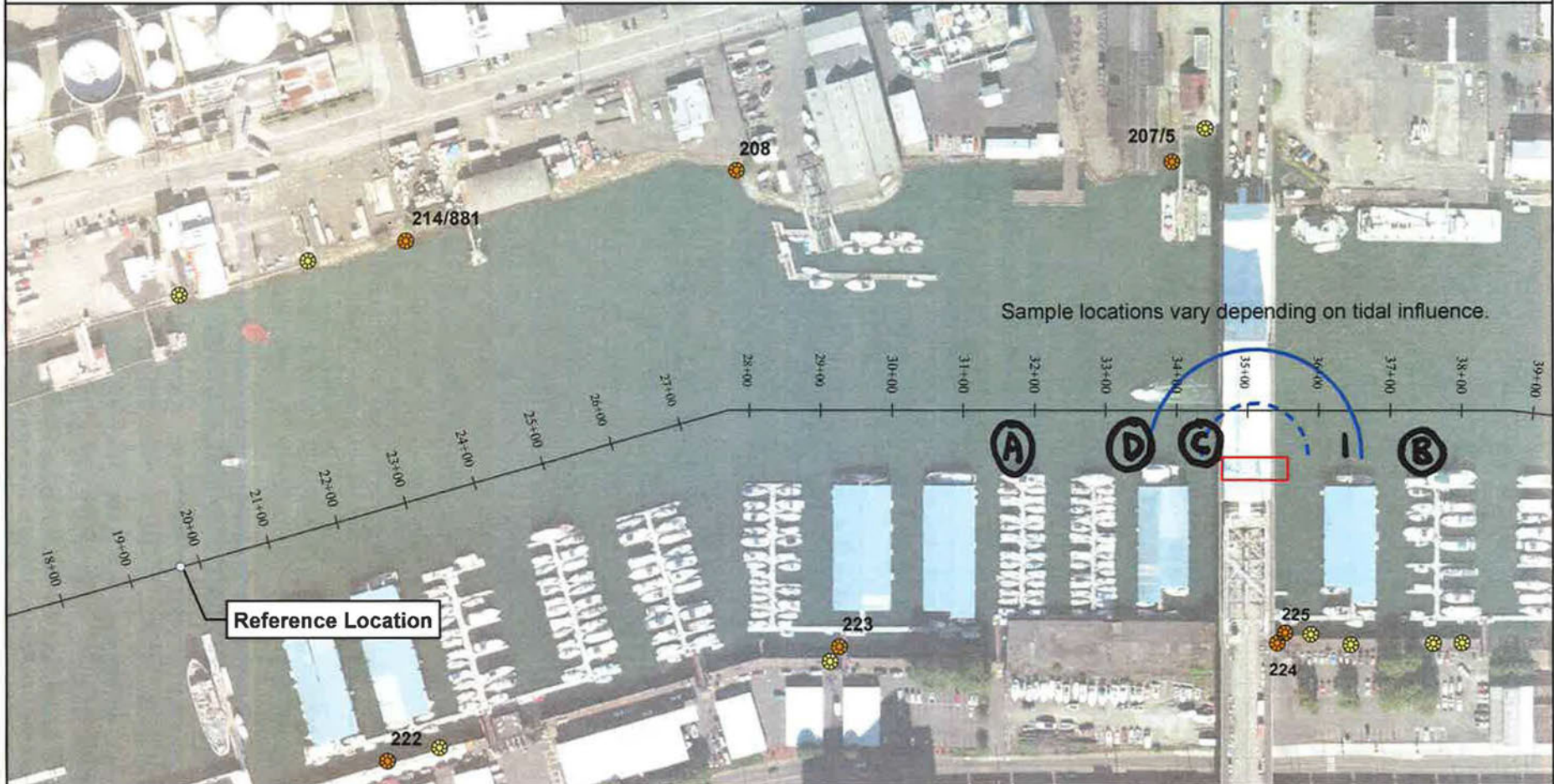
# WATER QUALITY MONITORING on 2/6/15

## Legend

- Reference Location  
(approximately 2,250 feet from the remedial activity<sup>1</sup>)
- City of Tacoma Outfall Location
- ⊗ Private Outfall Location
- Mid-Point Monitoring Location  
(75 feet down current of remedial activity)
- Point of Compliance Monitoring Locations  
(150 feet down current and up current of remedial activity)
- Dredge and Cap Extent (3,000 square feet)

### Notes:

- 1 The reference monitoring location is approximately half way between the remedial activity and Commencement Bay or the mouth of the waterway.
- Orthoimage provided by Esri.



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Figure C.2  
Water Quality Monitoring Locations

# Water Quality Monitoring Form

## Murray Morgan Bridge Remedial Action

Location

- ☐ 150-ft compliance location (down current)
- ☐ 75-ft midpoint location

- ☐ 150-ft up current location
- ☒ Reference location

LOCATION (A) : "AMBIENT DATA"

ABOUT 300' DOWNSTREAM OF WORK AREA

Date	Time	Depth (surface, midpoint, bottom)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Notes [tidal conditions (slack or strong ebb and/or flood), weather, calibration, etc.]	Name of Personnel Collecting Sample
2/6/15	7:16	3'	3.2	8.08	10.00	7.25	FLOOD, OVERCAST	V. UY
2/6/15	7:17	21'	3.1	7.54	9.85	7.54	FLOOD, OVERCAST	V. UY
2/6/15	7:18	39'	3.5	7.19	9.83	7.58	FLOOD, OVERCAST	

# Water Quality Monitoring Form

## Murray Morgan Bridge Remedial Action

Location

☐ 150-ft compliance location (down current)

☒ 150-ft up current location

LOCATION (B)

☐ 75-ft midpoint location

☐ Reference location

Date	Time	Depth (surface, midpoint, bottom)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Notes [tidal conditions (slack or strong ebb and/or flood), weather, calibration, etc.]	Name of Personnel Collecting Sample
2/6/15	9:05	3'	10.3	8.43	10.04	6.57	EBB, SHOWERS	V. UY
2/6/15	9:06	19'	10.2	7.70	9.85	7.17	EBB, SHOWERS	V. UY
2/6/15	9:07	35'	10.5	7.28	9.87	7.32	EBB, SHOWERS	V. UY

# Water Quality Monitoring Form

## Murray Morgan Bridge Remedial Action

Location

- ☐ 150-ft compliance location (down current)
 ☐ 150-ft up current location  
☒ 75-ft midpoint location (down current)
 ☐ Reference location

LOCATION ©

Date	Time	Depth (surface, midpoint, bottom)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Notes [tidal conditions (slack or strong ebb and/or flood), weather, calibration, etc.]	Name of Personnel Collecting Sample
2/6/15	9:25	3'	13.0	8.09	10.06	7.42	EBB, SHOWERS	V. UY
2/6/15	9:26	20'	10.6	7.61	9.85	7.47	EBB, SHOWERS	V. UY
2/6/15	9:27	37'	12.8	7.22	9.82	7.47	EBB, SHOWERS	V. UY



# Water Quality Monitoring Form

## Murray Morgan Bridge Remedial Action

Location

☒ 150-ft compliance location (down current)

☐ 150-ft up current location

☐ 75-ft midpoint location

☐ Reference location

LOCATION (D)

Date	Time	Depth (surface, midpoint, bottom)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Notes [tidal conditions (slack or strong ebb and/or flood), weather, calibration, etc.]	Name of Personnel Collecting Sample
2/6/15	9:33	3'	14.4	8.05	10.10	7.47	EBB, SHOWERS	V. UY
2/6/15	9:34	20'	10.4	7.60	9.84	7.48	EBB, SHOWERS	V. UY
2/6/15	9:35	38'	12.2	7.27	9.82	7.48	EBB, SHOWERS	V. UY



# Water Quality Monitoring Form

## Murray Morgan Bridge Remedial Action

Location

☐ 150-ft compliance location (down current)

☐ 75-ft midpoint location

☐ 150-ft up current location

☒ Reference location

ABOUT 300' DOWNSTREAM OF WORK AREA

LOCATION (A) : REPO OF "AMBIENT"

Date	Time	Depth (surface, midpoint, bottom)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Notes [tidal conditions (slack or strong ebb and/or flood), weather, calibration, etc.]	Name of Personnel Collecting Sample
2/6/15	9:46	3'	13.0	8.22	10.0	7.49	EBB, SHOWERS	V. UY
2/6/15	9:47	21'	10.4	7.56	9.84	7.49	EBB, SHOWERS	V. UY
2/6/15	9:48	39'	11.7	7.14	9.84	7.47	EBB, SHOWERS	V. UY

# Water Quality Monitoring Form

## Murray Morgan Bridge Remedial Action

Location

☐ 150-ft compliance location (down current)

☒ 150-ft up current location

☐ 75-ft midpoint location

☐ Reference location

LOCATION (B)

Date	Time	Depth (surface, midpoint, bottom)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Notes [tidal conditions (slack or strong ebb and/or flood), weather, calibration, etc.]	Name of Personnel Collecting Sample
2/6/15	10:15	3'	10.6	8.20	10.07	7.48	EBB, SHOWERS	V. UY
2/6/15	10:16	18'	10.2	7.58	9.84	7.49	EBB, SHOWERS	V. UY
2/6/15	10:17	33'	10.6	7.28	9.81	7.48	EBB, SHOWERS	V. UY

# Water Quality Monitoring Form

## Murray Morgan Bridge Remedial Action

Location

☒ 150-ft compliance location (down current)

☐ 150-ft up current location

☐ 75-ft midpoint location

☐ Reference location

LOCATION (D)

Date	Time	Depth (surface, midpoint, bottom)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Notes [tidal conditions (slack or strong ebb and/or flood), weather, calibration, etc.]	Name of Personnel Collecting Sample
2/6/15	10:32	3'	10.7	7.99	10.01	7.49	EBB, SHOWERS	V. WY
2/6/15	10:33	19'	10.3	7.54	9.84	7.49	EBB, SHOWERS	V. WY
2/6/15	10:34	36'	10.7	7.09	9.86	7.47	EBB, SHOWERS	V. WY

# Water Quality Monitoring Form

## Murray Morgan Bridge Remedial Action

Location

☐ 150-ft compliance location (down current)

☒ 150-ft up current location

☐ 75-ft midpoint location

☐ Reference location

LOCATION (B)

Date	Time	Depth (surface, midpoint, bottom)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Notes [tidal conditions (slack or strong ebb and/or flood), weather, calibration, etc.]	Name of Personnel Collecting Sample
2/6/15	11:03	3'	10.1	8.23	9.94	7.52	EBB, RAINING	V. UY
2/6/15	11:04	18'	10.2	7.69	9.84	7.50	EBB, RAINING	V. UY
2/6/15	11:04	33'	10.5	7.37	9.85	7.48	EBB, RAINING	V. UY

# Water Quality Monitoring Form

## Murray Morgan Bridge Remedial Action

Location

- ☐ 150-ft compliance location (down current)
 ☐ 150-ft up current location  
☒ 75-ft midpoint location (down current)
 ☐ Reference location

LOCATION (C)

Date	Time	Depth (surface, midpoint, bottom)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Notes [tidal conditions (slack or strong ebb and/or flood), weather, calibration, etc.]	Name of Personnel Collecting Sample
2/6/15	11:09	3'	10.1	8.46	9.92	7.48	EBB, RAIN	V. WY
2/6/15	11:10	18'	10.3	7.96	9.84	7.49	EBB, RAIN	V. WY
2/6/15	11:10	39'	10.8	7.57	9.83	7.48	EBB, RAIN	V. WY



# Water Quality Monitoring Form

## Murray Morgan Bridge Remedial Action

Location

☒ 150-ft compliance location (down current)

☐ 150-ft up current location

☐ 75-ft midpoint location

☐ Reference location

LOCATION (D)

Date	Time	Depth (surface, midpoint, bottom)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Notes [tidal conditions (slack or strong ebb and/or flood), weather, calibration, etc.]	Name of Personnel Collecting Sample
2/6/15	11:12	3'	10.4	8.76	10.04	7.50	EBB, RAIN	V. UY
2/6/15	11:13	19'	10.3	8.01	9.84	7.49	EBB, RAIN	V. UY
2/6/15	11:14	35'	10.9	7.57	9.83	7.48	EBB, RAIN	V. UY

# Water Quality Monitoring Form

## Murray Morgan Bridge Remedial Action

Location

☐ 150-ft compliance location (down current)

☐ 75-ft midpoint location

☐ 150-ft up current location

☒ Reference location

LOCATION (A): "AMBIENT" CHECK

300' DOWNSTREAM OF WORK AREA

Date	Time	Depth (surface, midpoint, bottom)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Notes [tidal conditions (slack or strong ebb and/or flood), weather, calibration, etc.]	Name of Personnel Collecting Sample
2/6/15	11:17	3'	10.5	8.88	10.00	7.48	EBB, RAIN	V.UY
2/6/15	11:18	21'	10.5	7.91	9.83	7.49	EBB, RAIN	V.UY
2/6/15	11:19	39'	10.9	7.54	9.81	7.48	EBB, RAIN	V.UY

WATER QUALITY MONITORING during dewatering session on 2/6/15 (Friday).







Monitoring performed about 75ft away (upstream and downstream) of water exit (from barge).

Photographs taken during dewatering are presented in Appendix A, Photographs 11 through 13

Depth (ft)	Time	Temp	pH	ODO	NTU
3	14:17:00	10.02	7.44	8.20	10.6
3	14:18:00	9.85	7.48	7.53	10.4
3	14:18:00	9.85	7.49	7.40	10.4
3	14:19:00	9.85	7.50	7.35	10.3
5	14:20:00	9.90	7.50	7.38	10.3
5	14:23:00	9.92	7.49	7.91	10.3
5	14:23:00	9.88	7.50	7.61	10.2
5	14:24:00	9.88	7.50	7.47	10.3
10	14:25:00	9.88	7.50	7.40	10.2
20	14:26:00	9.89	7.50	7.41	10.2
3	14:28:00	9.92	7.47	8.44	10.4
3	14:28:00	9.85	7.49	7.90	10.3
5	14:29:00	9.82	7.49	7.51	10.4
5	14:29:00	9.88	7.50	7.42	10.3
3	14:31:00	9.94	7.50	7.45	10.3
3	14:31:00	9.88	7.50	7.44	10.2
5	14:32:00	10.04	7.52	7.46	10.2
5	14:33:00	10.09	7.50	7.50	10.8
5	14:34:00	9.90	7.48	7.46	10.5
10	14:36:00	9.88	7.50	7.36	10.2
5	14:38:00	9.91	7.48	8.20	10.7
5	14:39:00	9.89	7.49	7.88	10.3
5	14:40:00	9.88	7.50	7.58	10.3
5	14:41:00	9.88	7.50	7.49	10.3
5	14:42:00	9.88	7.50	7.45	10.2

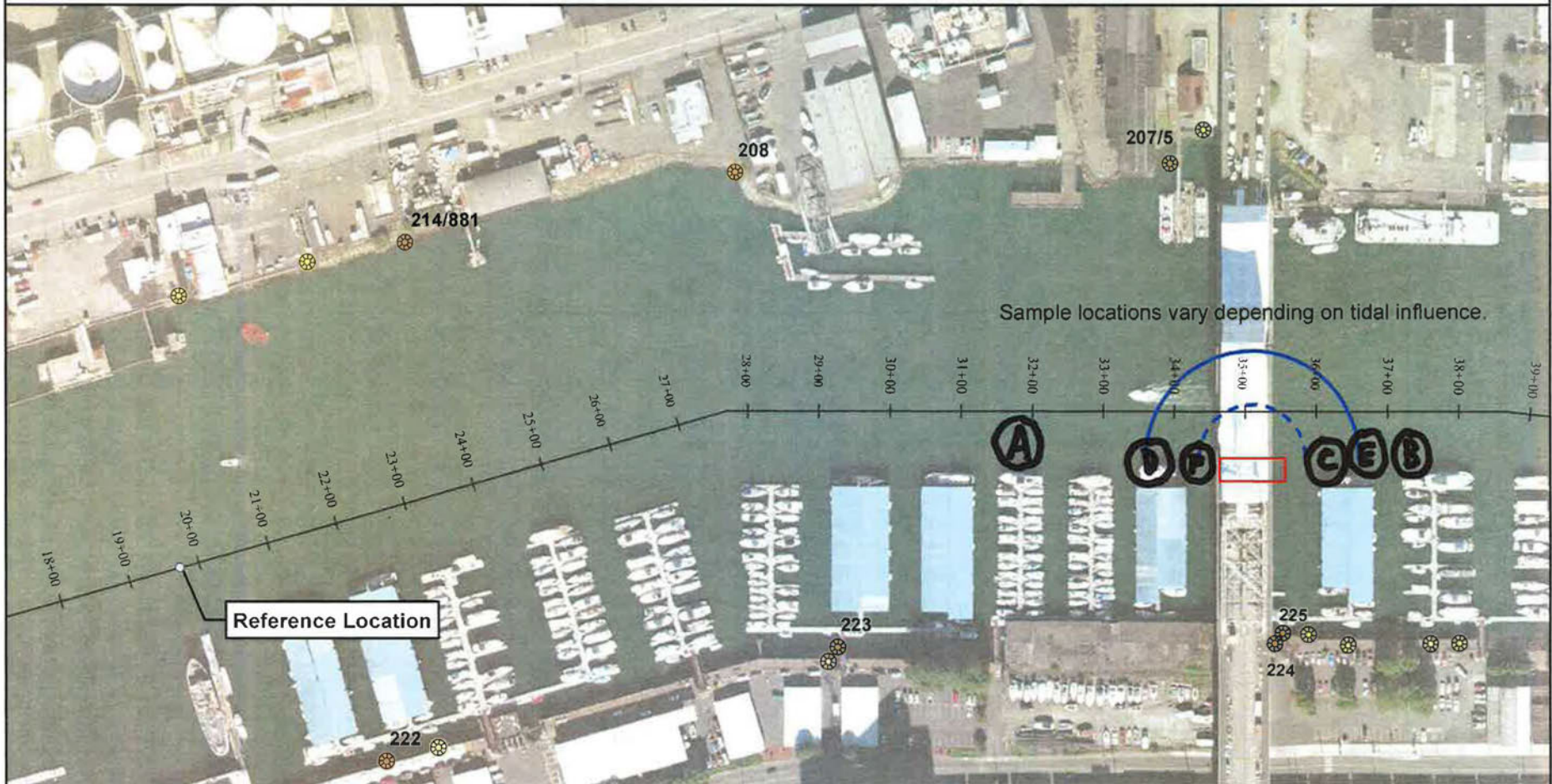
# WATER QUALITY MONITORING on 2/12/15

### Legend

- |   |   |   |   |
|---|---|---|---|
|  | Reference Location<br>(approximately 2,250 feet from the remedial activity) |  | Mid-Point Monitoring Location<br>(75 feet down current of remedial activity)                            |
|  | City of Tacoma Outfall Location   |  | Point of Compliance Monitoring Locations<br>(150 feet down current and up current of remedial activity) |
|  | Private Outfall Location  |  | Dredge and Cap Extent (3,000 square feet)   |

Notes:

1 The reference monitoring location is approximately half way between the remedial activity and Commencement Bay or the mouth of the waterway.  
 \* Orthoimage provided by Esri.



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Figure C.2  
Water Quality Monitoring Locations

# Water Quality Monitoring Form

## Murray Morgan Bridge Remedial Action

Location

☐ 150-ft compliance location (down current)

☐ 150-ft up current location

LOCATION (A): AMBIENT DATA

☐ 75-ft midpoint location

☒ Reference location

About 300' UPSTREAM OF WORK AREA

Date	Time	Depth (surface, midpoint, bottom)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Notes [tidal conditions (slack or strong ebb and/or flood), weather, calibration, etc.]	Name of Personnel Collecting Sample
2/12/15	7:01	3'	-0.8	8.64	9.89	6.92	FLOOD, OVERCAST	V. UY
2/12/15	7:02	21'	-1.1	7.81	9.75	7.22	FLOOD, OVERCAST	V. UY
2/12/15	7:02	39'	-0.9	7.51	9.73	7.39	FLOOD, OVERCAST	V. UY



# Water Quality Monitoring Form

## Murray Morgan Bridge Remedial Action

Location

☒ 150-ft compliance location (down current)

☐ 150-ft up current location

☐ 75-ft midpoint location

☐ Reference location

LOCATION (B)

Date	Time	Depth (surface, midpoint, bottom)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Notes [tidal conditions (slack or strong ebb and/or flood), weather, calibration, etc.]	Name of Personnel Collecting Sample
2/12/15	8:44	3'	0.8	7.72	9.95	6.54	FLOOD, CLEAR	V. HY
2/12/15	8:45	18'	0.7	7.40	9.76	7.24	FLOOD, CLEAR	V. HY
2/12/15	8:46	34'	1.0	7.36	9.72	7.53	FLOOD, CLEAR	V. HY

# Water Quality Monitoring Form

## Murray Morgan Bridge Remedial Action

Location

- ☐ 150-ft compliance location (down current)
 ☐ 150-ft up current location  
☒ 75-ft midpoint location (DOWN CURRENT)
 ☐ Reference location

LOCATION (C)

Date	Time	Depth (surface, midpoint, bottom)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Notes [tidal conditions (slack or strong ebb and/or flood), weather, calibration, etc.]	Name of Personnel Collecting Sample
2/12/15	8:50	3'	0.9	9.25	9.72	7.55	FLOOD, CLEAR	V. WY
2/12/15	8:51	17'	0.8	7.73	9.76	7.66	FLOOD, CLEAR	V. WY
2/12/15	8:52	32'	2.4	7.74	9.73	7.70	FLOOD, CLEAR	V. WY

# Water Quality Monitoring Form

## Murray Morgan Bridge Remedial Action

Location

☐ 150-ft compliance location (down current)

☒ 150-ft up current location

☐ 75-ft midpoint location

☐ Reference location

LOCATION ①

Date	Time	Depth (surface, midpoint, bottom)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Notes [tidal conditions (slack or strong ebb and/or flood), weather, calibration, etc.]	Name of Personnel Collecting Sample
2/12/15	8:58	3'	0.7	9.32	9.98	7.64	FLOOD, CLEAR	V. WY
2/12/15	8:58	20'	1.5	8.17	9.77	7.67	FLOOD, CLEAR	V. WY
2/12/15	8:59	37'	1.0	7.56	9.72	7.72	FLOOD, CLEAR	V. WY

# Water Quality Monitoring Form

## Murray Morgan Bridge Remedial Action

Location

☐ 150-ft compliance location (down current)

☐ 150-ft up current location

☒ 150-Ft during slack tide  
LOCATION (E)

☐ 75-ft midpoint location

☐ Reference location

Date	Time	Depth (surface, midpoint, bottom)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Notes [tidal conditions (slack or strong ebb and/or flood), weather, calibration, etc.]	Name of Personnel Collecting Sample
2/12/15	10:35	3'	1.0	8.00	9.95	7.52	SLACK TIDE, CLEAR	V. UY
2/12/15	10:36	18'	2.8	7.51	9.75	7.65	SLACK TIDE, CLEAR	V. UY
2/12/15	10:37	35'	0.9	7.35	9.74	7.70	SLACK TIDE, CLEAR	V. UY

# Water Quality Monitoring Form

## Murray Morgan Bridge Remedial Action

Location

☐ 150-ft compliance location (down current)

☐ 150-ft up current location

☐ 75-ft midpoint location

☐ Reference location

☒ 150-ft during slack tide  
LOCATION (D)

Date	Time	Depth (surface, midpoint, bottom)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Notes [tidal conditions (slack or strong ebb and/or flood), weather, calibration, etc.]	Name of Personnel Collecting Sample
2/12/15	10:42	3'	0.8	8.55	10.01	7.66	SLACK TIDE, OVERCAST	V. UY
2/12/15	10:43	20'	0.9	7.59	9.75	7.70	SLACK TIDE, OVERCAST	V. UY
2/12/15	10:44	37'	0.3	7.35	9.75	7.72	SLACK TIDE, OVERCAST	V. UY



# Water Quality Monitoring Form

## Murray Morgan Bridge Remedial Action

Location

☐ 150-ft compliance location (down current)

☐ 150-ft up current location

☒ 75-ft midpoint location

☐ Reference location

LOCATION (F)

Date	Time	Depth (surface, midpoint, bottom)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Notes [tidal conditions (slack or strong ebb and/or flood), weather, calibration, etc.]	Name of Personnel Collecting Sample
2/12/15	10:51	3'	1.0	8.92	10.02	7.68	SLACK TIDE, OVERCAST	V. WY
2/12/15	10:52	20'	4.0	7.77	9.75	7.70	SLACK TIDE, OVERCAST	V. WY
2/12/15	10:52	37'	7.7	7.32	9.75	7.71	SLACK TIDE, OVERCAST	V. WY

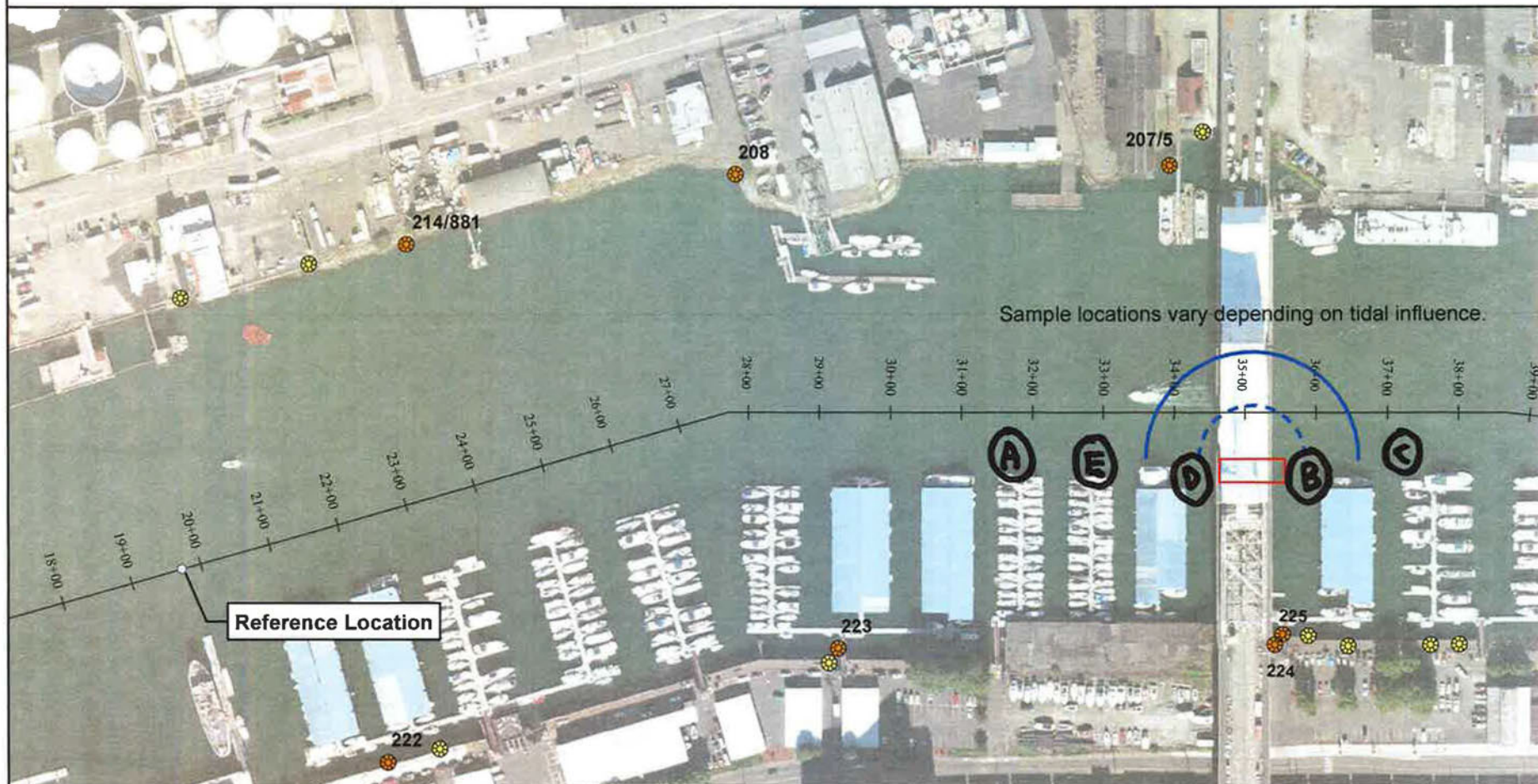
# WATER QUALITY MONITORING on 2/13/15

## Legend

- Reference Location  
(approximately 2,250 feet from the remedial activity<sup>1</sup>)
- City of Tacoma Outfall Location
- ⊗ Private Outfall Location
- Mid-Point Monitoring Location  
(75 feet down current of remedial activity)
- Point of Compliance Monitoring Locations  
(150 feet down current and up current of remedial activity)
- Dredge and Cap Extent (3,000 square feet)

### Notes:

- 1 The reference monitoring location is approximately half way between the remedial activity and Commencement Bay or the mouth of the waterway.
- Orthoimage provided by Esri.



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**Remedial Action Work Plan  
Murray Morgan Bridge Remedial Action  
Tacoma, Washington**

Figure C.2  
Water Quality Monitoring Locations

# Water Quality Monitoring Form

## Murray Morgan Bridge Remedial Action

Location

- ☐ 150-ft compliance location (down current)  
☐ 75-ft midpoint location

- ☐ 150-ft up current location  
☒ Reference location

LOCATION (A) : AMBIENT DATA

About 300' NORTH OF WORK AREA

Date	Time	Depth (surface, midpoint, bottom)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Notes [tidal conditions (slack or strong ebb and/or flood), weather, calibration, etc.]	Name of Personnel Collecting Sample
2/13/15	7:37	3'	0.2	8.95	10.04	6.48	FLOOD, CLEAR SKIES	V. WY
2/13/15	7:37	21'	0.6	7.75	9.73	7.12	FLOOD, CLEAR SKIES	V. WY
2/13/15	7:38	39'	0.5	7.39	9.72	7.33	FLOOD, CLEAR SKIES	V. WY

# Water Quality Monitoring Form

## Murray Morgan Bridge Remedial Action

Location

- ☐ 150-ft compliance location (down current)
 ☐ 150-ft up current location  
☒ 75-ft midpoint location (~~DOWN CURRENT~~)
 ☐ Reference location

LOCATION (B)

Date	Time	Depth (surface, midpoint, bottom)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Notes [tidal conditions (slack or strong ebb and/or flood), weather, calibration, etc.]	Name of Personnel Collecting Sample
2/13/15	8:51	3'	0.3	8.15	10.04	7.53	FLOOD, CLEAR SKIES	V. UY
2/13/15	8:52	17'	0.3	7.54	9.79	7.55	FLOOD, CLEAR SKIES	V. UY
2/13/15	8:53	32'	0.4	7.29	9.73	7.59	FLOOD, CLEAR SKIES	V. UY



# Water Quality Monitoring Form

## Murray Morgan Bridge Remedial Action

Location

☒ 150-ft compliance location (down current)

☐ 150-ft up current location

☐ 75-ft midpoint location

☐ Reference location

LOCATION (C)

Date	Time	Depth (surface, midpoint, bottom)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Notes [tidal conditions (slack or strong ebb and/or flood), weather, calibration, etc.]	Name of Personnel Collecting Sample
2/13/15	8:58	3'	0.4	8.64	10.11	7.54	FLOOD, CLEAR SKIES	V. WY
2/13/15	8:59	20'	0.6	7.59	9.75	7.58	FLOOD, CLEAR SKIES	V. WY
2/13/15	9:00	37'	3.7	7.28	9.73	7.60	FLOOD, CLEAR SKIES	V. WY



# Water Quality Monitoring Form

## Murray Morgan Bridge Remedial Action

Location

☐ 150-ft compliance location (down current)

☒ 150-ft up current location

☐ 75-ft midpoint location

☐ Reference location

LOCATION (D)

Date	Time	Depth (surface, midpoint, bottom)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Notes [tidal conditions (slack or strong ebb and/or flood), weather, calibration, etc.]	Name of Personnel Collecting Sample
2/13/15	9:07	3'	0.1	8.60	9.97	7.57	FLOOD, CLEAR SKIES	V. HY
2/13/15	9:08	20'	0.5	7.76	9.74	7.59	FLOOD, CLEAR SKIES	V. HY
2/13/15	9:08	37'	0.5	7.48	9.72	7.61	FLOOD, CLEAR SKIES	V. HY

# Water Quality Monitoring Form

## Murray Morgan Bridge Remedial Action

Location

☐ 150-ft compliance location (down current)

☐ 150-ft up current location

☒ 150-ft during slack tide  
LOCATION (B)

☐ 75-ft midpoint location

☐ Reference location

Date	Time	Depth (surface, midpoint, bottom)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Notes [tidal conditions (slack or strong ebb and/or flood), weather, calibration, etc.]	Name of Personnel Collecting Sample
2/13/15	11:30	3'	0.6	8.54	10.25	6.99	SLACK TIDE, CLEAR	V. WY
2/13/15	11:31	17'	0.7	7.61	9.74	7.41	SLACK TIDE, CLEAR	V. WY
2/13/15	11:31	32'	2.9	7.38	9.73	7.51	SLACK TIDE, CLEAR	V. WY

# Water Quality Monitoring Form

## Murray Morgan Bridge Remedial Action

Location

☐ 150-ft compliance location (down current)

☐ 150-ft up current location

☒ 150-Ft during slack tide  
LOCATION (E)

☐ 75-ft midpoint location

☐ Reference location

Date	Time	Depth (surface, midpoint, bottom)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Notes [tidal conditions (slack or strong ebb and/or flood), weather, calibration, etc.]	Name of Personnel Collecting Sample
2/13/15	11:37	3'	0.7	9.03	10.16	7.55	SLACK TIDE, CLEAR	V. UY
2/13/15	11:37	20'	0.4	7.85	9.75	7.55	SLACK TIDE, CLEAR	V. UY
2/13/15	11:38	37'	0.3	7.39	9.72	7.60	SLACK TIDE, CLEAR	V. UY

# Water Quality Monitoring Form

## Murray Morgan Bridge Remedial Action

Location

☐ 150-ft compliance location (down current)

☐ 150-ft up current location

☒ 75-ft midpoint location

☐ Reference location

LOCATION (D)

Date	Time	Depth (surface, midpoint, bottom)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Notes [tidal conditions (slack or strong ebb and/or flood), weather, calibration, etc.]	Name of Personnel Collecting Sample
2/13/15	11:44	3'	0.7	8.84	10.12	7.52	SLACK TIDE, CLEAR	V. UY
2/13/15	11:45	20'	0.0	7.89	9.86	7.53	SLACK TIDE, CLEAR	V. UY
2/13/15	11:46	37'	0.3	7.42	9.72	7.59	SLACK TIDE, CLEAR	V. UY



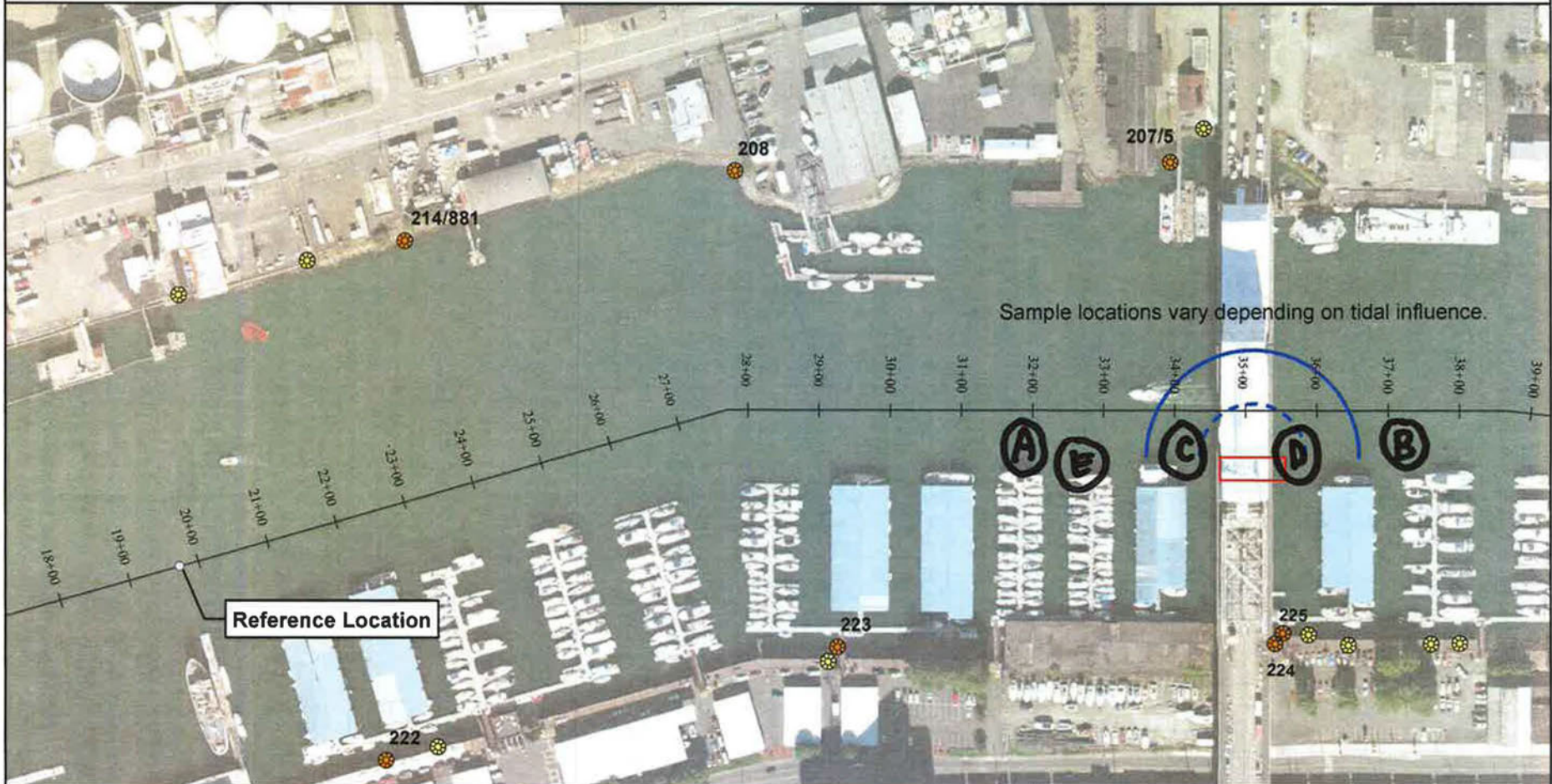
# WATER QUALITY MONITORING on 2/14/15

## Legend

- Reference Location  
(approximately 2,250 feet from the remedial activity<sup>1</sup>)
- City of Tacoma Outfall Location
- ⊗ Private Outfall Location
- Mid-Point Monitoring Location  
(75 feet down current of remedial activity)
- Point of Compliance Monitoring Locations  
(150 feet down current and up current of remedial activity)
- Dredge and Cap Extent (3,000 square feet)

### Notes:

- 1 The reference monitoring location is approximately half way between the remedial activity and Commencement Bay or the mouth of the waterway.
- Orthoimage provided by Esri.



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**Remedial Action Work Plan  
Murray Morgan Bridge Remedial Action  
Tacoma, Washington**

**Figure C.2  
Water Quality Monitoring Locations**



# Water Quality Monitoring Form

## Murray Morgan Bridge Remedial Action

Location

☐ 150-ft compliance location (down current)

☐ 150-ft up current location

☐ 75-ft midpoint location

☒ Reference location

LOCATION (A): AMBIENT DATA

About 300' NORTH OF WORK AREA

Date	Time	Depth (surface, midpoint, bottom)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Notes [tidal conditions (slack or strong ebb and/or flood), weather, calibration, etc.]	Name of Personnel Collecting Sample
2/14/15	7:21	3'	0.1	7.32	10.07	6.27	FLOOD, CLEAR SKIES	V. UY
2/14/15	7:22	19'	0.2	5.08	9.76	6.63	FLOOD, CLEAR SKIES	V. UY
2/14/15	7:22	34'	0.4	4.64	9.76	6.63	FLOOD, CLEAR SKIES	V. UY

# Water Quality Monitoring Form

## Murray Morgan Bridge Remedial Action

Location

☒ 150-ft compliance location (down current)

☐ 150-ft up current location

☐ 75-ft midpoint location

☐ Reference location

VISUAL OBSERVATIONS ONLY.  
LOCATION (B)

Date	Time	Depth (surface, midpoint, bottom)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Notes [tidal conditions (slack or strong ebb and/or flood), weather, calibration, etc.]	Name of Personnel Collecting Sample
2/14/15	9:05	SURFACE	CLEAR	—	—	—	FLOOD, CLEAR SKIES	V. UY





ET-1

ET-1



# Water Quality Monitoring Form

## Murray Morgan Bridge Remedial Action

Location

☐ 150-ft compliance location (down current)

☐ 150-ft up current location

☒ 75-ft midpoint location

☐ Reference location

VISUAL OBSERVATIONS ONLY.

LOCATION (D)

Date	Time	Depth (surface, midpoint, bottom)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Notes [tidal conditions (slack or strong ebb and/or flood), weather, calibration, etc.]	Name of Personnel Collecting Sample
2/14/15	9:08	SURFACE	CLEAR	—	—	—	FLOOD, CLEAR SKIES.	V. UY





# Water Quality Monitoring Form

## Murray Morgan Bridge Remedial Action

Location

☐ 150-ft compliance location (down current)

☒ 150-ft up current location

VISUAL OBSERVATIONS ONLY.

☐ 75-ft midpoint location

☐ Reference location

Date	Time	Depth (surface, midpoint, bottom)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Notes [tidal conditions (slack or strong ebb and/or flood), weather, calibration, etc.]	Name of Personnel Collecting Sample
2/14/15	9:10	SURFACE	CLEAR	—	—	—	FLOOD, CLEAR SKIES	V. HY







# Water Quality Monitoring Form

## Murray Morgan Bridge Remedial Action

Location

☒ 150-ft compliance location (down current)

☐ 150-ft up current location

☐ 75-ft midpoint location

☐ Reference location

VISUAL OBSERVATIONS ONLY.  
LOCATION (D)

Date	Time	Depth (surface, midpoint, bottom)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Notes [tidal conditions (slack or strong ebb and/or flood), weather, calibration, etc.]	Name of Personnel Collecting Sample
2/14/15	10:45	SURFACE	CLEAR	—	—	—	FLOOD, CLEAR SKIES	V. WY







# Water Quality Monitoring Form

## Murray Morgan Bridge Remedial Action

Location

- ☐ 150-ft compliance location (down current)  
☐ 75-ft midpoint location

- ☒ 150-ft up current location  
☐ Reference location

VISUAL OBSERVATIONS ONLY.  
 LOCATION (E)

Date	Time	Depth (surface, midpoint, bottom)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Notes [tidal conditions (slack or strong ebb and/or flood), weather, calibration, etc.]	Name of Personnel Collecting Sample
2/14/15	10:47	SURFACE	CLEAR	—	—	—	FLOOD, CLEAR SKIES	V. UY







# Water Quality Monitoring Form

## Murray Morgan Bridge Remedial Action

Location

☐ 150-ft compliance location (down current)

☐ 150-ft up current location

☒ 75-ft midpoint location

☐ Reference location

VISUAL OBSERVATIONS ONLY.

LOCATION (C)

Date	Time	Depth (surface, midpoint, bottom)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temp. (°C)	pH	Notes [tidal conditions (slack or strong ebb and/or flood), weather, calibration, etc.]	Name of Personnel Collecting Sample
2/14/15	10:49	SURFACE	CLEAR	—	—	—	FLOOD, CLEAR SKIES	V.UY





55

NICK



# Memorandum

**To:** William Ryan and Justine Barton, U.S. Environmental Protection Agency  
**Copies:** Mary Henley and Tom Rutherford, City of Tacoma  
**From:** Jessi Massingale and Amanda McKay, Floyd|Snider  
**Date:** February 11, 2015  
**Project No:** COT-MMB Task 4000  
**Re: Actions Taken during Murray Morgan Bridge Remedial Action Project  
Dewatering Activities**

---

On February 6, 2015, during dredge material dewatering activities for the Murray Morgan Bridge Remedial Action Project, a turbidity plume was observed below the western discharge point/scupper of the dewatering system (Figure 1). It is estimated that the plume was approximately 10 to 20 feet long, 5 to 10 feet wide, and a couple feet deep. This memorandum presents documentation of the best management practices (BMPs) that were implemented to reduce the release of turbid water and the water quality monitoring activities that were conducted in response to the visible turbidity plume.

Upon completion of dredging, dewatering was initiated at approximately 1:45 pm. The dewatering hose was placed on the eastern side of the dewatering pond. Shortly after pumping started, a turbidity plume became visible below the western discharge point/scupper. The Floyd|Snider field representative, Amanda McKay, directed the marine contractor (American) to stop dewatering in order to investigate the cause of the turbidity.<sup>1</sup>

Due to the lean of the receiving barge, water was hitting the base of the dewatering area on the eastern end and flowing across the barge deck (and within the dewatering area) to the discharge point/scupper on the western side rather than discharging to the closer, eastern discharge point/scupper (Figure 1). In order to address the turbidity, the dewatering hose was moved to the western side of the dewatering area to facilitate discharge through additional BMPs, as described below:

1. The discharge hose was confirmed to be pulling water from 1 to 2 feet above the sediment in the containers to prevent sediment uptake into the hosing.

---

<sup>1</sup> On the first day of dredging, Thursday, February 5, 2015, BMPs implemented to prevent water running along the length of deck outside of dewatering area and to the western discharge point/scupper were effective and eliminated this water from discharging. Additionally, as dredging continued, American was able to reduce the amount of water falling on the deck during placement of sediment into the containers.

2. Additional layers of geotextile fabric were placed along the inside of the western wall of the dewatering area, directly on top of the discharge point.
3. Straw wattles were placed on top of the additional layers of geotextile along the inside of the western wall of the dewatering area.
4. Two straw wattles were wrapped in geotextile fabric and placed on the outside of the western wall of the dewatering area (directly after discharge at the corner scupper) to provide an additional layer of filtration prior to discharge to the waterway.

Upon implementation of the BMPs, American was directed to recommence dewatering. Shortly thereafter, a small turbidity plume become visible at the western discharge point/scupper. This turbidity plume appeared to be less turbid than the initial turbidity plume, indicating the BMPs were successful in reducing the turbidity of discharge water. However, because the water leaving the west discharge point/scupper was still slightly turbid, Amanda directed American to stop dewatering. Amanda asked American to turn the pump discharge speed down but American confirmed the pump was on its lowest speed. American implemented the following BMPs to further minimize turbidity:

1. Several more layers of geotextile fabric were placed along the inside corner of the dewatering area, on top of the west discharge point/scupper.
2. Four additional straw wattles were placed along the inside of the western wall (above the additional geotextile fabric) of the dewatering area (for a total of six) and two of them were wrapped in geotextile fabric.
3. The two straw wattles were confirmed to still be placed correctly on the outside of the western wall, directly on top of the western discharge point/scupper.

Once these BMPs were implemented, Amanda directed American to continue dewatering and commence water quality monitoring to confirm that the turbidity was not impacting the mid-point or compliance monitoring locations. Turbidity measurements were collected at the 75-foot mid-point station. During turbidity monitoring, the plume was observed to shift direction and move north so the 75-foot mid-point location was shifted to the north, downcurrent of the plume. Measurements were collected every few minutes at depths of 3 feet and 5 feet below the water surface. In order to confirm the plume was only present on the surface and not at depth, American collected three turbidity measurement at 10 feet and 20 feet below the water surface. Turbidity measurements ranged from 10.2 to 10.7 nephelometric turbidity units (NTUs) and are consistent with turbidity measurements collected throughout the day at the compliance and reference monitoring locations (Attachment 1).

Additional dredging of localized high spots is scheduled to start on Thursday, February 12, 2015, followed by dewatering and capping. Based on lessons learned, if a visible turbidity plume is observed during dewatering, the BMPs summarized above will be implemented again to ensure the turbidity plume does not increase in size and impact compliance monitoring locations.



However, if a turbidity plume is observed, and turbidity measurements at the 75-foot mid-point location are elevated, the following additional BMPs will be implemented in sequence, with the second BMP implemented if the first does not reduce turbidity:

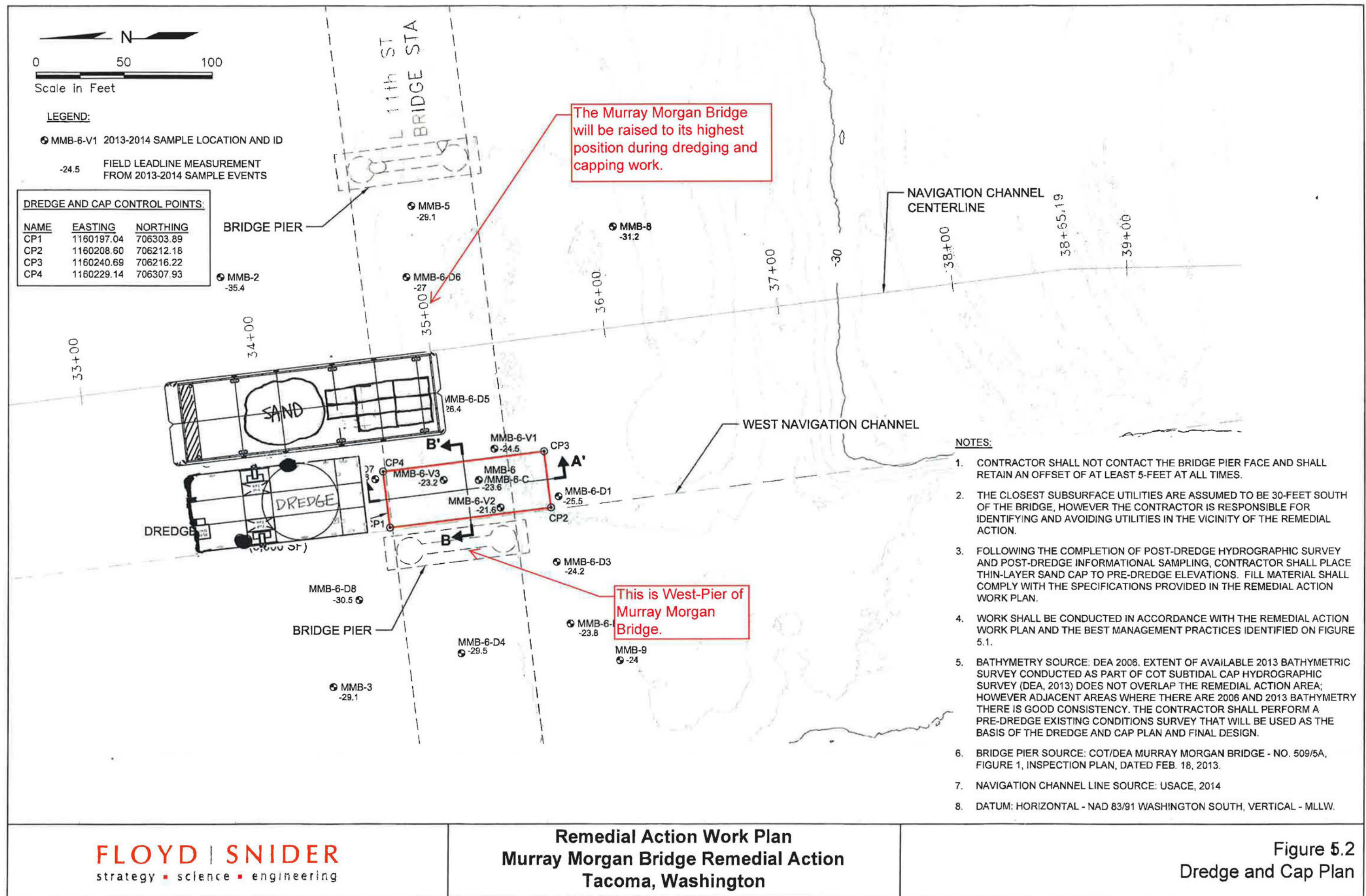
1. The water will be allowed to settle further by pumping water into containers in succession, allowing additional sediment settlement prior to discharge.
2. The current 100-gallon per minute (gpm) pump will be switched to a slower, 20-gpm pump to minimize turbidity during pumping.

If turbidity measurements at the 75-foot mid-point are elevated relative to compliance and reference measurements, the Floyd|Snider representative will notify and discuss with U.S. Environmental Protection Agency.

#### **LIST OF ATTACHMENTS**

Figure 1      February 6, 2015 Dewatering Activities

Attachment 1 Water Quality Measurements during Dewatering



**Murray Morgan Bridge Remedial Action**

**Remedial Action  
Construction Report**

**Appendix D  
Thin-Layer Sand Cap Specifications**

Table D.1  
Chemical Criteria and Results for Murray Morgan Bridge Sand Cap and Activated Carbon Material

Analyte	Unit	Sediment Quality Objective	Sediment Quality Standard	1/2 Sediment Quality Objective	1/2 Sediment Quality Standard	Selected Criteria for Comparison <sup>1</sup>	Channel Sand Cap Material Results	Channel Sand Cap Material Results (Diluted)	Activated Carbon Cap Material Results
Metals									
Antimony	mg/kg	150	--	75	--	75	0.12 U	0.12 U	2.9 U
Arsenic	mg/kg	57	57	28.5	28.5	29	1.7	1.7	2.9 U
Cadmium	mg/kg	5.1	5.1	2.55	2.55	2.6	0.12 U	0.12 U	0.96 U
Copper	mg/kg	390	390	195	195	200	11	11	9.4
Lead	mg/kg	450	450	225	225	230	1.3	1.3	1.4 U
Mercury	mg/kg	0.59	0.41	0.295	0.205	0.20	0.016 U	0.016 U	0.016 U
Nickel	mg/kg	140	--	70	--	70	16	16	0.96 U
Silver	mg/kg	6.1	6.1	3.05	3.05	3.1	0.12 U	0.12 U	2.4 U
Zinc	mg/kg	410	410	205	205	210	23	23	1.9 U
Semivolatile Organic Compounds									
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs)									
2-Methylnaphthalene	µg/kg	670	670	335	335	340	19 U	19 U	19 UJ
Acenaphthene	µg/kg	500	500	250	250	250	19 U	19 U	19 UJ
Acenaphthylene	µg/kg	1,300	1,300	650	650	650	19 U	19 U	19 UJ
Anthracene	µg/kg	960	960	480	480	480	19 U	19 U	19 UJ
Fluorene	µg/kg	540	540	270	270	270	19 U	19 U	19 UJ
Naphthalene	µg/kg	2,100	2,100	1050	1050	1100	5.3 U	5.3 U	19 UJ
Phenanthrene	µg/kg	1,500	1,500	750	750	750	19 U	19 U	19 UJ
Total LPAHs	µg/kg	5,200	5,200	2600	2600	2600	19 U	19 U	19 UJ
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs)									
Benzo(a)anthracene	µg/kg	1,600	1,300	800	650	650	19 U	19 U	19 UJ
Benzo(a)pyrene	µg/kg	1,600	1,600	800	800	800	29 U	29 U	290 UJ
Total Benzofluoranthenes	µg/kg	3,600	3,200	1800	1600	1600	43 U	43 U	430 UJ
Benzo(g,h,i)perylene	µg/kg	720	670	360	335	340	24 U	24 U	240 UJ
Chrysene	µg/kg	2,800	1,400	1400	700	700	24 U	24 U	24 UJ
Dibenz(a,h)anthracene	µg/kg	230	230	115	115	120	39 U	39 U	380 UJ
Fluoranthene	µg/kg	2,500	1,700	1250	850	850	19 U	19 U	19 UJ
Indeno(1,2,3-cd)pyrene	µg/kg	690	600	345	300	300	39 U	39 U	380 UJ
Pyrene	µg/kg	3,300	2,600	1,650	1,300	1,300	19 U	19 U	19 UJ
Total HPAHs	µg/kg	17,000	12,000	8,500	6,000	6,000	43 U	43 U	430 UJ
Other									
Dimethylphthalate	µg/kg	160	71	80	35.5	36	97 U	15 U	96 UJ
Diethylphthalate	µg/kg	200	200	100	100	100	190 U	30 U	190 UJ
Di-n-Butylphthalate	µg/kg	1,400	1,400	700	700	700	490 U	490 U	480 UJ
Butylbenzylphthalate	µg/kg	900	63	450	31.5	32	190 U	190 U	190 UJ
bis(2-Ethylhexyl)phthalate	µg/kg	1,300	1,300	650	650	650	580 U	580 U	580 UJ
Di-n-Octyl phthalate	µg/kg	6,200	6,200	3,100	3,100	3,100	490 U	490 U	4800 UJ
Phenol	µg/kg	420	420	210	210	210	97 U	97 U	96 UJ
2-Methylphenol	µg/kg	63	63	31.5	31.5	32	97 U	15	96 UJ
4-Methylphenol	µg/kg	670	670	335	335	340	NT	NT	NT
2,4-Dimethylphenol	µg/kg	29	29	14.5	14.5	15	96 U	15 U	96 UJ
Pentachlorophenol	µg/kg	360	360	180	180	180	190 U	30 U	190 UJ
Benzyl Alcohol	µg/kg	73	57	36.5	28.5	29	97 U	15 U	96 UJ
Benzoic Acid	µg/kg	650	650	325	325	330	2,400 U	380 U	2,400 UJ
1,2-Dichlorobenzene	µg/kg	50	35	25	17.5	18	2.1 U	2.1 U	53 UJ
1,3-Dichlorobenzene	µg/kg	170		85	--	85	2.1 U	2.1 U	48 UJ
1,4-Dichlorobenzene	µg/kg	110	110	55	55	55	1.1 U	1.1 U	48 UJ
1,2,4-Trichlorobenzene	µg/kg	51	31	25.5	15.5	16	2.1 U	2.1 U	48 UJ
Hexachlorobenzene	µg/kg	22	22	11	11	11	49 U	7.6 U	48 UJ
Dibenzofuran	µg/kg	540	540	270	270	270	97 U	97 U	96 UJ
Hexachlorobutadiene	µg/kg	11	11	5.5	5.5	5.5	2.1 U	2.1 U	48 UJ
N-Nitrosodiphenylamine	µg/kg	28	28	14	14	14	49 U	7.6 U	48 UJ
Pesticides									
4,4'-DDD	µg/kg	16		8	--	8.0	1.9 U	1.9 U	2 UJ
4,4'-DDE	µg/kg	9		4.5	--	4.5	1.9 U	1.9 U	2 UJ
4,4'-DDT	µg/kg	34		17	--	17	1.9 U	1.9 U	2 UJ
Polychlorinated Biphenyls (PCBs)									
Total PCBs	µg/kg	300	130	150	65	65	10 U	10 U	91 UJ
Miscellaneous									
Total Organic Carbon	%			--	--	--	0.2 U	0.2 U	94
Total Solids	%			--	--	--	98	98	97
Total Moisture	%			--	--	--	3.6	3.6	3.4
Particle Specific Gravity				--	--	--	2.731	2.731	--
Modified Proctor				--	--	--	NT	NT	--
Grain size distribution				--	--	--	See specs	See specs	--
Weight per unit volume	lbs/ft <sup>3</sup>			--	--	--	109	109	--

Notes:

- Reporting limit greater than lowest criterion; 2 significant figures
- Not available.
- 1 Two significant figures.

Abbreviations:

- % percent
- DDD Dichlorodiphenyldichloroethane
- DDE Dichlorodiphenyldichloroethylene
- DDT Dichlorodiphenyltrichloroethane
- lbs/ft<sup>3</sup> pounds per cubit foot

Qualifiers:

- U Analyte was not detected at the associated reporting limit.
- UJ Analyte was not detected at the associated reporting limit, which is considered an estimate.

- µg/kg Micrograms per kilogram
- mg/kg Milligrams per kilogram
- NT Not tested
- SQO Sediment quality objective
- SQS Sediment Quality Standard



**Marine Construction Dredging Pile Driving**

1501 Taylor Way • Tacoma, Washington 98421

PHONES: Tacoma (253) 254-0118,

Seattle (206) 623-0114,

Fax (253) 254-0155



CONTRACTORS LIC NO. 223-01-AM-ER-IC\*372 NO.

DATE 1/14/15

JOB #: MD - 14

TITLE: Murray Morgan Bridge  
Remedial Dredging

TO:

City of Tacoma  
747 Market Street  
Tacoma, WA 98402

Attn: Tom Rutherford

THE FOLLOWING ITEMS ARE BEING SENT: Herewith ☒  
Under Separate Cover ☐  
Direct ☐

QUANTITY	DESCRIPTION
1 EA	Submittal 001: Channel Sap Cap submittal
	Includes: Product #7143 Data Sheet - from CalPortland (supplier)

These items are being sent:

<input checked="" type="checkbox"/>	Per your request
<input checked="" type="checkbox"/>	Please keep us advised of action taken
<input checked="" type="checkbox"/>	For you to process
<input checked="" type="checkbox"/>	For your inspection and approval
<input type="checkbox"/>	For your general information and file
<input type="checkbox"/>	For your approval or corrections

**REMARKS:**

Please contact us promptly if there is a problem or question

COPY TO:

File

AMERICAN CONSTRUCTION CO., INC.

BY:

Vernon Uy

# CalPortland - Aggregate Submittal



Date: **September 18, 2014**

Product Number: **7143**

Product Description: **Channel Sand Cap W/0.1 TOC**

Specification Number: **Alternate**

Source: **Pioneer Aggregates**

Location: **DuPont WA**

WSDOT Pit Number: **B-335**

## Specification:

3/8" square	100% passing	% Fracture	-
U.S. No. 4	60-100	Sand Equivalent	
U.S. No. 10	20-45	L.A. Wear	-
U.S. No. 40	2-8	Degradation:	-
U.S. No. 200	2 max.	Dust Ratio	-

Specific Gravity: **2.701**

Absorption: **1.34**

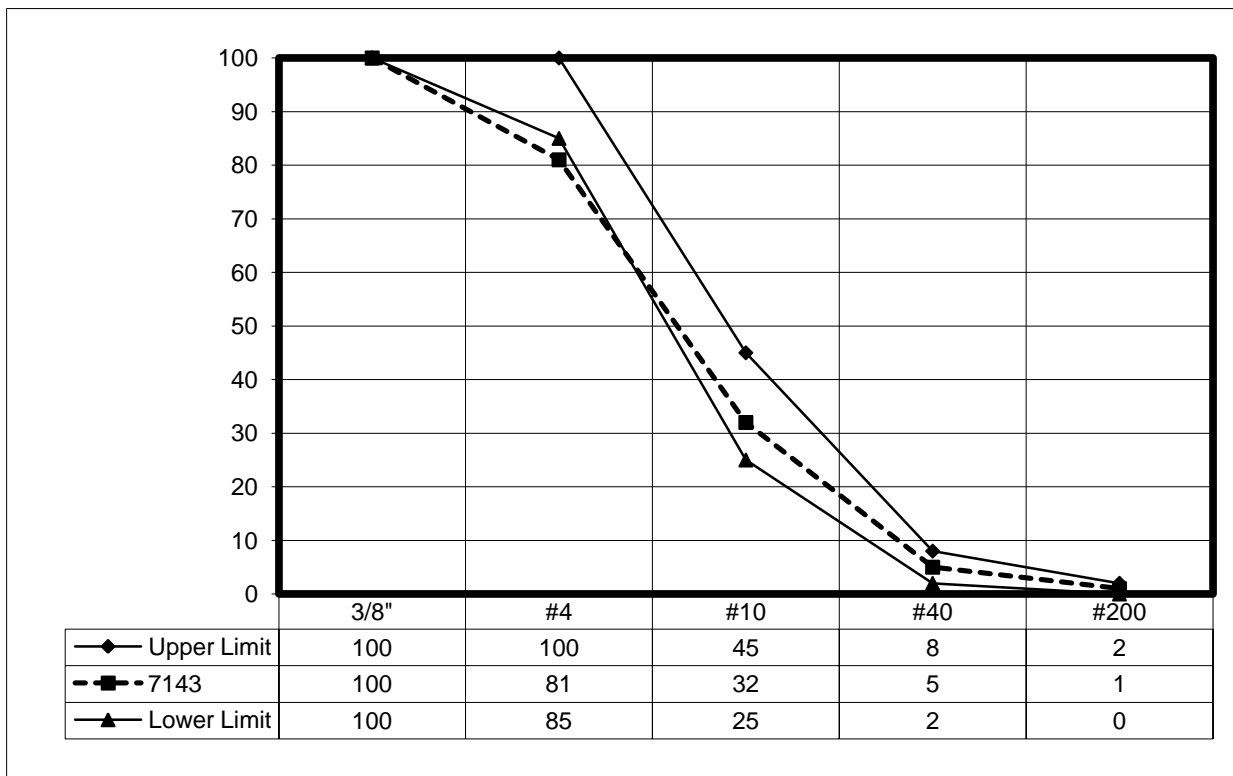
L.A. Abrasion: **13.0%**

Degradation: **82**

% Fracture: **n/a**

Sand Equivalent: **90**

Dust Ratio: **Pass**





Professional Service Industries, Inc.  
10025 South Tacoma Way, #H1  
Tacoma, WA 98499

Phone: (253) 589-1804  
Fax: (253) 589-2136

# Material Test Report

Report No: MAT:07421290-2-S1

Issue No: 1

Client: AMERICAN CONSTRUCTION CC:  
1501 TAYLOR WAY  
TACOMA, WA 98421

Project: CAL PORTLAND SAND CAP MATERIAL  
DUPONT, WA

These test results apply only to the specific locations and materials noted and may not represent any other locations or elevations. This report may not be reproduced, except in full, without written permission by Professional Service Industries, Inc. If a non-compliance appears on this report, to the extent that the reported non-compliance impacts the project, the resolution is outside the PSI scope of engagement.

Approved Signatory: Mike Kath (Branch Manager)  
Date of Issue: 1/29/2015

## Sample Details

Sample ID: 07421290-2-S1  
Client Sample ID:  
Date Sampled: 01/26/15  
Sampled By: Fred Jespersen  
Specification:  
Supplier: Cal-Portland  
Source: DuPont Pit (#B-335)  
Material: Sand Cap Material  
Sampling Method: Stockpile/Trans - ASTM D 75 - 5.3.3  
General Location:  
Location:  
Lift:

## Other Test Results

Description	Method	Result	Limits
Bulk Density (lb/ft <sup>3</sup> )	ASTM C 29	109	
Voids (%)			
Filling Procedure		Rodding	
Tested By		Mark Peterson	
Date Tested		1/27/2015	
Maximum Dry Density (lb/ft <sup>3</sup> )	ASTM D 1557	119.8	
Corrected Maximum Dry Density (lb/ft <sup>3</sup> )		119.8	
Optimum Moisture Content (%)		7.5	
Corrected Optimum Moisture Content (%)		7.5	
Method		C	
Preparation Method		Dry	
Specific Gravity (Fines)	ASTM D 854	2.73	
	ASTM D 1557		
Tested By		Mark Peterson	
Date Tested		1/27/2015	
Maximum Dry Density (lb/ft <sup>3</sup> )	ASTM D 698	120.4	
Corrected Maximum Dry Density (lb/ft <sup>3</sup> )		120.4	
Optimum Moisture Content (%)		7.3	
Corrected Optimum Moisture Content (%)		7.3	
Method		A	
Preparation Method		Dry	
Specific Gravity (Fines)	ASTM D 854	2.73	
Retained Sieve No 4 (4.75mm) (%)		0	
	ASTM D 698		
Tested By		Mark Peterson	
Date Tested		1/27/2015	
Specific Gravity (at 20°C)	ASTM D 854	2.731	
Average Specific Gravity (at 20°C)		2.73	
Method		B	
Passing 4.75mm (No.4) (%)			

## Particle Size Distribution

## Chart

## Comments

Note 0.1% activated carbon added to sample based on dry weight.



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# Material Test Report

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Project: CAL PORTLAND SAND CAP MATERIAL  
DUPONT, WA

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Specification:  
Supplier: Cal-Portland  
Source: DuPont Pit (#B-335)  
Material: Sand Cap Material  
Sampling Method: Stockpile/Trans - ASTM D 75 - 5.3.3  
General Location:  
Location:  
Lift:

## Other Test Results

Description	Method	Result	Limits
Test temperature (°C)		20.0	
Tested By		Mark Peterson	
Date Tested		1/27/2015	

## Particle Size Distribution

Limits

## Chart

## Comments

Note 0.1% activated carbon added to sample based on dry wieght.



**Marine Construction Dredging Pile Driving**

1501 Taylor Way • Tacoma, Washington 98421

PHONES: Tacoma (253) 254-0118,

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Fax (253) 254-0155



CONTRACTORS LIC NO. 223-01-AM-ER-IC\*372 NO.

**TO:**

City of Tacoma  
747 Market Street  
Tacoma, WA 98402

Attn: Tom Rutherford

**DATE** 1/21/2015

**JOB #:** MD - 14

**TITLE:** Murray Morgan Bridge  
Remedial Dredging

THE FOLLOWING ITEMS ARE BEING SENT: Herewith

Under Separate Cover

Direct

<b>x</b>

QUANTITY	DESCRIPTION
1 EA	Submittal 002: Active Carbon submittal
	Includes: OLC 12x40 from CalgonCarbon

These items are being sent:

<b>x</b>	Per your request
<b>x</b>	Please keep us advised of action taken
<b>x</b>	For you to process
<b>x</b>	For your inspection and approval
	For your general information and file
	For your approval or corrections

**REMARKS:**

Please contact us promptly if there is a problem or question

**COPY TO:**

AMERICAN CONSTRUCTION CO., INC.

**BY:**

Vernon Uy

## OLC 12x40

### Coconut Granular Activated Carbon

#### Description

OLC 12x40 is a coconut activated carbon for the removal of dissolved organic contaminants from water, wastewater and process liquids. These contaminants include taste and odor compounds, organic color, total organic carbon (TOC) and industrial chemicals such as chlorinated solvents (TCE, PCE). It is produced under controlled conditions by high temperature steam activation. The pore structure enables it to be used for adsorption of both high and low molecule weight impurities from waters and liquids. The carbon is especially effective for adsorbing trace organic compounds such as vinyl chloride, methylene chloride, MTBE and THM's/disinfection by-products. OLC 12 x 40 is certified to NSF/ANSI 61 standard and complies with the requirements for activated carbon as defined by the Food Chemicals Codex (FCC) (8th Edition) published by the U.S. Pharmacopeia.

#### Features

- Coconut carbon
- Low ash
- High mechanical strength

#### Benefits

- A strongly adsorbing pore structure optimal for the treatment of chlorine and other organics
- High hardness relative to other raw materials
- Hardness and abrasion resistance required for thermal reactivation and minimizing generation of fines in operations requiring backwashing
- Pore structure provides a wide range of contaminant removal capabilities

#### Applications

OLC 12x40 coconut activated carbon can be used in a variety of water, wastewater and process liquid applications for the removal of dissolved organic compounds. OLC 12x40 has been used in applications such as process water purification, wastewater treatment and industrial chemical purification.

#### Specifications

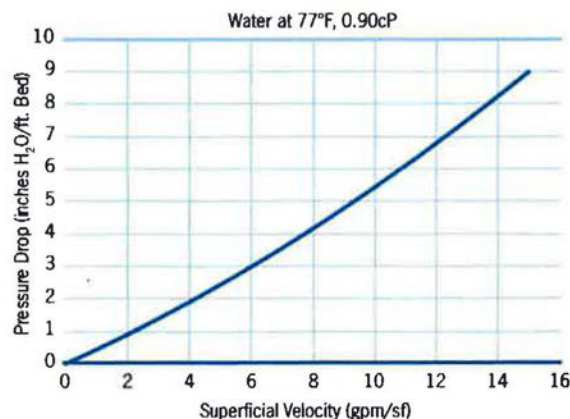
#### OLC 12x40

Iodine Number, mg/g	1050 (min)
Ash, wt%	4.0 (max)
Moisture (As Packaged), wt%	5 (max)
Density (Apparent), g/cc	0.48 (min)
Hardness Number	95 (min)
12 US Mesh [1.70 mm], wt%	5 (max)
< 40 US Mesh [0.425 mm] (PAN), wt%	4 (max)

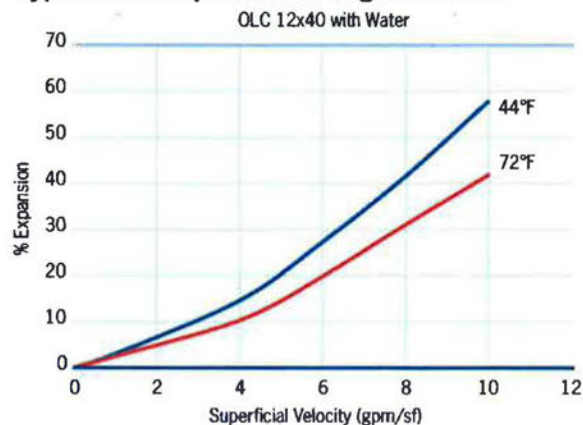
#### Design Considerations

OLC 12x40 coconut activated carbon is typically applied in down-flow packed bed operations using both pressure and gravity systems. Design considerations for a carbon system is based on the user's operating conditions, the treatment objectives desired, and the chemical nature of the compounds being adsorbed. In general, downflow superficial velocity can be from 1 gpm/ft<sup>2</sup> to 10 gpm/ft<sup>2</sup>, depending on the application and contact times can vary from 7.5 minutes to hours. Design may vary based on the type water/liquid, contaminants to remove, and desired treatment objectives. To determine what is best for your application and assistance with the design, please contact Calgon Carbon Corporation by calling 1-800-4-CARBON.

#### Typical Pressure Drop (OLC 12x40)



### Typical Bed Expansion During Backwash



### Packaging

Please contact Calgon Carbon for options and availability.

### Safety Message

Wet activated carbon preferentially removes oxygen from air. In closed or partially closed containers and vessels, oxygen depletion may reach hazardous levels. If workers are to enter a vessel containing carbon, appropriate sampling and work procedures for potentially low oxygen spaces should be followed, including all applicable federal and state requirements. Please refer to the MSDS for all up to date product safety information.

[www.calgoncarbon.com](http://www.calgoncarbon.com)



**Corporate Headquarters**  
Calgon Carbon Corporation  
500 Calgon Carbon Drive  
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412.787.6700  
412.787.6713 Fax

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Calgon Carbon Asia Pte Ltd.  
9 Temasek Boulevard  
#26-02 Suntec Tower Two  
Singapore 038989  
+65 6221 3500  
+65 6221 3554 Fax

Your local representative



# Material Safety Data Sheet

U.S. Department of Labor  
Occupational Safety and Health Administration  
This form is consistent with ANSI standard for  
preparation of MSDS's in accordance with  
OSHA's Hazard Communication Standard,  
29 CFR 1910.1200.

<b>Product Type: OLC 12X40</b>	
<b>Product Code: 2490</b>	<b>Profile No: 2</b>
<b>Effective Date:</b> December 30, 2011	<b>Supersedes:</b> January 17, 2011

## SECTION I - PRODUCT AND COMPANY INFORMATION


<b>Product Name</b>	Activated Carbon (Coconut Based)	
<b>Product Use</b>	Used according to manufacturer's recommendation	
<b>Company Identification (USA)</b>	<b>Calgon Carbon Corporation</b> P.O. Box 717 Pittsburgh, PA 15230-0717	
<b>Telephone Number(s)</b>	Information	412-787-6700
	Emergency	412-787-6700
<b>Company Identification (Europe)</b>	<b>Chemviron Carbon</b> Zoning Industriel de Feluy B-7181 Feluy, Belgium	
<b>Telephone Number(s)</b>	Information	32 64 51 18 11
	Emergency	32 64 51 18 11
<b>Date Prepared</b>	Signature of Preparer	
<b>January 21, 2015</b>	(optional)	

## SECTION II – HAZARD(S) IDENTIFICATION

<b>OSHA Regulatory Status:</b>		Not regulated	
<b>HMIS Ratings:</b>	Health	0	4 = Extreme/Severe 3 = High/Serious 2 = Moderate 1 = Slight 0 = Minimum W = Water Reactive OX = Oxidizer
(NFPA)	Flammability	1	
	Reactivity	0	
	Special		
<b>Protective Equipment :</b>		Safety glasses with side shields or goggles, gloves, long sleeve shirt or lab coat, long pants recommended.	
<b>Health Effects:</b>		See Section IV.	
<b>Environmental Effects:</b>		See Section XII.	



**GHS Classification:**

Hazard Symbol	Hazard / Category	Warning
	Eye Irritation Category 2B Respiratory Irritation Category 3	Contact may cause eye irritation. Dust may be slightly irritating to eyes and respiratory tract.  Wet activated carbon removes oxygen from air causing a severe hazard to workers in enclosed or confined space.
<b>Precautionary Statements</b>		
<b>Prevention:</b>	Avoid generation of dust during handling. Avoid breathing dust. Wash thoroughly after handling. Use in a well-ventilated area.	
<b>Response:</b>	IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing.  IF IN EYES: Rinse cautiously with water for several minutes.	
<b>Storage:</b>	Store in a well-ventilated place. Keep container tightly closed.	
<b>Container Labeling:</b>	While Calgon Carbon Corporation has added GHS classification information to MSDS documents, changes to container labeling has not been implemented. Changes to container labels will be made in accordance to the requirements to be defined by OSHA's revision to the Hazard Communication Standard once final adoption of rule is approved and released.	

**SECTION III – COMPOSITION /INFORMATION ON INGREDIENTS**

Chemical Identity (% by Wt)	Common Name (Ingredient / Component)	CAS No	Impurities
100	Activated Carbon (Coconut based)	7440-44-0	None

**SECTION IV – FIRST-AID MEASURES**

Route of Exposure	
<b>Inhalation</b>	Dust may cause mild irritation to the upper respiratory tract.
<b>Skin</b>	Dust may cause mild irritation, possibly reddening.
<b>Eyes</b>	Dust may cause mild irritation, possibly reddening.
<b>Ingestion</b>	Dust may cause mild irritation to digestive track resulting in nausea or diarrhea.
<b>Signs/Symptoms of Exposure</b>	Dust may cause irritation and redness of eyes, irritation of skin and respiratory system. The effects of long-term, low-level exposures to this product have not been determined.
<b>Emergency and First Aid</b>	For eye contact: Immediately flush with copious amounts of

<b>Procedures</b>	<p>water for at least 15 minutes, lifting both the upper and lower lids occasionally; seek medical attention.</p> <p>For skin contact: Wash with soap and water; seek medical attention.</p> <p>For inhalation: Remove to fresh air and rest as needed; seek medical attention for any breathing difficulty.</p> <p>For ingestion: Drink plenty of water; seek medical attention.</p>
<b>Medical Conditions Generally Aggravated by Exposure</b>	People with pre-existing skin conditions or eye problems or impaired respiratory function may be more susceptible to the potential effects of the dust.

## SECTION V – FIRE FIGHTING MEASURES

<b>Suitable Extinguishing Media</b>	Use an extinguishing media suitable for the surrounding fire.
<b>Unsuitable Extinguishing Media</b>	None known
<b>Specific Hazards</b>	<p>As with most organic solids, fire is possible at elevated temperatures or by contact with an ignition source. Activated carbon is difficult to ignite and tends to burn slowly (smolder) without producing smoke or flame.</p> <p>Carbon monoxide and carbon dioxide gas may be emitted upon combustion of material.</p> <p>Contact with strong oxidizers such as ozone or liquid oxygen may cause rapid combustion.</p>
<b>Protective Equipment and Procedures</b>	Wear NIOSH approved self-contained breathing apparatus suitable for the surrounding fire.

## SECTION VI – ACCIDENTAL RELEASE MEASURES

<b>Personal Precautions</b>	Wear protective equipment, keep unnecessary personnel away, and ventilate area of spill.
<b>Environmental Precautions</b>	The material is not soluble, but can cause a particulate emission if discharged to waterways; therefore, dike all entrances to sewers and drains to avoid introducing the material into the waterways.
<b>Containment &amp; Clean-up</b>	<p>Dike all entrances to sewers and drains. Vacuum or shovel spilled material and place in closed container for disposal.</p> <p>Remove product to appropriate storage area until it can be properly disposed of in accordance with local, state and federal regulations. Avoid dust formation.</p> <p>See section XIII.</p>
<b>Other Information</b>	NA

## SECTION VII – HANDLING AND STORAGE

<b>Precautions for Safe Handling</b>	Avoid prolonged contact with eyes and skin. Keep away from ignition sources. Use in well ventilated areas. Protect containers from physical damage. Wash hands after handling.
<b>Conditions for Safe Storage</b>	Store in cool, dry, ventilated area and in closed containers. Keep away from oxidizers, heat or flames. Store away from ignition sources.

## SECTION VIII – EXPOSURE CONTROLS/PERSONAL PROTECTION

Component	OSHA PEL	ACGIH TLV	Other Limits
Activated Carbon	Data not available	Data not available	
<b>Exposure Guidelines</b>	Wet activated carbon removes oxygen from air posing a hazard to workers in enclosed or confined space. Before entering such an area, sample the air to assure sufficient oxygen supply. Use work procedures for low oxygen levels, observing all local, state and federal regulations.		
<b>Engineering Controls</b>	<p>Exhaust ventilation should be designed to prevent accumulation and recirculation in the workplace and safely remove carbon black from the air.</p> <p>Note: Wet activated carbon removes oxygen from air causing a severe hazard to workers in enclosed or confined space.</p> <p>If risk of overexposure exists, wear an approved respirator. Provide adequate ventilation in warehouse or closed storage area.</p>		
<b>Personal Protective Equipment</b>	Use of NIOSH approved particulate filter is recommended if dust is generated in handling. The usual precautionary measures for handling chemicals should be followed, i.e. gloves, safety glasses w/side shields or goggles, long sleeve shirt or lab coat, dust respirator if dusty and/or other protective clothing/equipment as determined appropriate.		
<b>General Hygiene</b>	The usual precautionary measures for handling chemicals should be followed: i.e. Keep away from food and beverage; remove contaminated clothing immediately; wash hands before breaks or eating; avoid contact with eyes and skin.		

## SECTION IX – PHYSICAL AND CHEMICAL PROPERTIES

<b>Physical State (Appearance)</b>		Black granular or powder material	
<b>Color</b>	Black	<b>Molecular Weight</b>	NA
<b>Odor</b>	None	<b>Odor Threshold</b>	None
<b>pH Value</b>	NA	<b>Vapor Pressure</b>	0

<b>Melting Point</b>	NA	<b>Vapor Density</b>	Solid
<b>Freezing Point</b>	NA	<b>Relative Density</b>	0.4 to 0.7
<b>Initial Boiling Point</b>	NA	<b>Solubility</b>	Not Soluble
<b>Flashpoint</b>	NA	<b>Partition Coefficient</b>	NA
<b>Evaporation Rate</b>	NA	<b>Auto Ignition Temp.</b>	>220 <sup>0</sup> C
<b>Flammability</b>	>220 <sup>0</sup> C	<b>Decomp. Temp.</b>	NA
<b>UEL</b>	NA	<b>Viscosity</b>	NA
<b>LEL</b>	NA		

## SECTION X – STABILITY AND REACTIVITY

CHEMICAL STABILITY	UNSTABLE		CONDITIONS TO AVOID: None
	STABLE	XX	
POSSIBILITY OF HAZARDOUS REACTION	MAY OCCUR		CONDITIONS TO AVOID: None
	WILL NOT OCCUR	XX	
<b>Caution:</b> High concentrations of organics in air will cause temperature rise due to heat of adsorption. At very high concentration levels this may result in a thermal excursion, referred to as a bed fire. High concentrations of Ketones and Aldehydes may cause a bed temperature rise due to adsorption and oxidation.			
Materials to Avoid			Alkali metals and strong oxidizers such as ozone, oxygen, permanganate, chlorine.
Hazardous Decomposition Products			Carbon monoxide and carbon dioxide gas may be generated during combustion of this material.

## SECTION XI – TOXICOLOGICAL INFORMATION

<b>Acute Effects</b>		
<b>Toxicity Studies</b>	Oral LD <sub>50</sub>	Not determined on the finished product.
	Dermal LD <sub>50</sub>	Not determined on the finished product.
<b>Inhalation</b>	See section IV.	
<b>Ingestion</b>	See section IV.	
<b>Eye Irritation</b>	See section IV.	
<b>Skin Irritation</b>	See section IV.	
<b>Sensitization</b>	Not determined on the finished product.	
<b>Target Organ (s) or System</b>		Eyes, skin and upper respiratory system
<b>Signs and Symptoms of Exposure</b>		Irritation and redness of eyes, irritation of skin and respiratory system may result from exposure to carbon dust.
		See Sections III and IV.
<b>Chronic Effects</b>		
<b>Carcinogenicity</b>		Not determined on the finished product.



<b>Mutagenicity</b>	Not determined on the finished product.
<b>Reproductive Effects</b>	Not determined on the finished product.
<b>Developmental Factors</b>	Not determined on the finished product.

## SECTION XII – ECOLOGICAL INFORMATION

<b>Ecotoxicity</b>	Not determined on the finished product.
<b>Persistence/Degradability</b>	Not determined on the finished product.
<b>Bioaccumulation/Accumulation</b>	Not determined on the finished product.
<b>Mobility in Environmental Media</b>	Not determined on the finished product.
<b>Other Adverse Effects</b>	Not determined on the finished product.

## SECTION XIII – DISPOSAL CONSIDERATIONS

Vacuum or shovel material into a closed container. Storage and disposal should be in accordance with applicable local, state and federal laws and regulations. Local regulations may be more stringent than state or federal requirements. Activated Carbon is an adsorbent media; hazard classification is generally determined by the adsorbate that the carbon has picked up. Consult with the US EPA Guidelines listed in 40 CFR Part 261.3 for the classifications of hazardous waste prior to disposal.

## SECTION XIV – TRANSPORT INFORMATION

**This information as presented below only applies to the material as shipped. The identification based on characteristic(s) or listing may not apply if the material has been used or otherwise contaminated. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste identification and disposal methods in compliance with applicable regulations.**

<b>Land</b>	DOT Regulations	UN/NA Identification Number:	OLC 12X40None on finished product
		UN- Proper Shipping Name:	Not Regulated
		Transport Hazard Class:	None on finished product; see Note 1 below
		Packing Group:	None on finished product
		Marine Pollutant:	None on finished product
	Canadian WHMIS	Hazard Class:	None on finished product
<b>Water</b>	IMO / IMDG	UN/NA Identification Number:	OLC 12X40None on finished product
		UN- Proper Shipping Name:	Not Regulated
		Transport Hazard Class:	None on finished product

		Packing Group:	None on finished product
		Marine Pollutant:	None on finished product
Air	ICAO / IATA	UN/NA Identification Number:	None on finished product
		UN- Proper Shipping Name:	Not Regulated
		Transport Hazard Class:	None on finished product
		Packing Group:	None on finished product
		Marine Pollutant:	None on finished product
		Information reported for product/size: 0.5 Kg	
<b>Note 1: Under the UN classification for activated carbon, all activated carbons have been identified as a class 4.2 product. However, This product has been tested according to the <u>United Nations Transport of Dangerous Goods</u> test protocol for a “self-heating substance” (<u>United Nations Transportation of Dangerous Goods, Manual of Tests and Criteria, Part III, Section 33.3.1.6 - Test N.4 - Test Method for Self Heating Substances</u>) and it has been specifically determined that this product does not meet the definition of a self heating substance (class 4.2) or any other hazard class, and therefore should not be listed as a hazardous material. This information is applicable only for the Activated Carbon Product identified in this document.</b>			

## SECTION XV – REGULATORY INFORMATION

<b>SARA Title III 302</b>	Product is not subject to SARA Title III, section 302 regulation.	
<b>SARA Title III 313</b>	Product is not subject to SARA Title III, section 313 regulation.	
<b>TSCA</b>	Product is listed.	
<b>California Proposition 65</b>	Product is not listed.	
<b>Canadian Classification</b>	<b>WHMIS</b>	Product is listed.
	<b>DSL #</b>	Product is listed.
<b>EEC Council Directives relating to the classification, packaging, and labeling of dangerous substances and preparations.</b>		
<b>Risk and Safety Phrases</b>	R36: Irritating to the eyes. R37: Irritating to the respiratory system. R38: Irritating to the skin.	
<b>Carbon, activated (CAS: 7440-44-0) is found on the following regulatory lists:</b>	Canada - British Columbia Occupational Exposure Limits Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances Canada Domestic Substances List (DSL) International Air Transport Association (IATA) Dangerous Goods Regulations OECD Representative List of High Production Volume (HPV) Chemicals US - Hawaii Air Contaminant Limits US - Idaho - Toxic and Hazardous Substances - Mineral Dust US - Minnesota Hazardous Substance List US - Minnesota Permissible Exposure Limits (PELs) US - Rhode Island Hazardous Substance List US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule	

	Limits for Air Contaminants US - Washington Permissible exposure limits of air contaminants US DOE Temporary Emergency Exposure Limits (TEELs) US EPA High Production Volume Program Chemical List US FDA CFSAN Color Additive Status List 4 US FDA CFSAN Color Additive Status List 6
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## SECTION XVI – OTHER INFORMATION

<b>Intended Use</b>	The material is generally used for treatment of gases and liquids.
The information contained in this document applies to this specific material as supplied. It may not be valid for this material if it is used in combination with any other materials. It is the user's responsibility to determine the suitability and completeness of this information for their particular use.	
While the information and recommendations set forth herein are believed to be accurate as of the date hereof, Calgon Carbon Corporation makes no warranty with respect to same and disclaims all liability for reliance there on.	

### Legend:

ACGIH	- American Conference of Governmental Industrial Hygienists
ANSI	- American National Standards Institute
CAS #	- Chemical Abstracts Service Registry Number
CFR	- Code of Federal Regulations
CFSAN	- Center for Food Safety and Applied Nutrition
DOE	- Department of Energy
DOT	- Department of Transportation
DSL	- Domestic Substances List
EEC	- European Economic Community
EPA	- Environmental Protection Agency
FDA	- Food and Drug Administration
GHS	- Globally Harmonized System (of Classification and Labeling of Chemicals)
HMIS	- Hazardous Material Information System
IATA	- International Air Transportation Association
ICAO	- International Civil Aviation Organization
IMO	- International Maritime Organization
IMDG	- International Maritime Dangerous Goods
LD <sub>50</sub>	- Lethal Dose expected to kill 50% of a group of test animals
LEL	- Lower Explosive Limit
NA	- Not Applicable
NFPA	- National Fire Protection Association
NIOSH	- National Institute for Occupational Safety and Health
OECD	- Organization for Economic Cooperation and Development
OSHA	- Occupational Safety and Health Association
PEL	- Permissible Exposure Limit
SARA	- Superfund Amendments and Reauthorization Act
TLV	- Threshold Limit Value
TSCA	- Toxic Substances Control Act
UEL	- Upper Explosive Limit
WHMIS	- Workplace Hazardous Material Information System

\* \* \* END OF MATERIAL SAFETY DATA SHEET \* \* \*

# TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

## ANALYTICAL REPORT

TestAmerica Laboratories, Inc.

TestAmerica Seattle

5755 8th Street East

Tacoma, WA 98424

Tel: (253)922-2310

TestAmerica Job ID: 580-47190-2

Client Project/Site: Cal-Portland Sand Cap Material

For:

Professional Service Industries (PSI)

10025 S. Tacoma Way #H1

Tacoma, Washington 98499

Attn: Mike Kath



Authorized for release by:

2/3/2015 9:02:29 AM

Kim Presley, Project Management Assistant I

(253)922-2310

[kim.presley@testamericainc.com](mailto:kim.presley@testamericainc.com)

Designee for

David Burk, Project Manager I

(253)248-4972

[david.burk@testamericainc.com](mailto:david.burk@testamericainc.com)

### LINKS

Review your project  
results through

TotalAccess

Have a Question?



Visit us at:

[www.testamericainc.com](http://www.testamericainc.com)

*This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.*

*Results relate only to the items tested and the sample(s) as received by the laboratory.*



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## Case Narrative

Client: Professional Service Industries (PSI)  
Project/Site: Cal-Portland Sand Cap Material

TestAmerica Job ID: 580-47190-2

**Job ID: 580-47190-2**

**Laboratory: TestAmerica Seattle**

### Narrative

#### Receipt

The sample was received on 1/26/2015 12:12 PM; the sample arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 14.3° C.

Except:

The following sample was re-activated by the client on 1/30/2015 for 8270 re-analysis using a 1ml extract volume to get lower reporting limits on 9 compounds.

#### GC/MS Semi VOA

No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

#### Organic Prep

No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

## Definitions/Glossary

Client: Professional Service Industries (PSI)  
Project/Site: Cal-Portland Sand Cap Material

TestAmerica Job ID: 580-47190-2

### Qualifiers

#### GC/MS Semi VOA

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

### Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
α	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

# Client Sample Results

Client: Professional Service Industries (PSI)  
Project/Site: Cal-Portland Sand Cap Material

TestAmerica Job ID: 580-47190-2

**Client Sample ID: S1**

**Date Collected: 01/26/15 11:00**

**Date Received: 01/26/15 12:12**

**Lab Sample ID: 580-47190-1**

**Matrix: Solid**

**Percent Solids: 96.5**

## Method: 8270D - Semivolatile Organic Compounds (GC/MS) - RE

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzoic acid	ND		380		ug/Kg	☼	02/02/15 10:53	02/02/15 18:03	1
Benzyl alcohol	ND		15		ug/Kg	☼	02/02/15 10:53	02/02/15 18:03	1
Diethyl phthalate	ND		30		ug/Kg	☼	02/02/15 10:53	02/02/15 18:03	1
Dimethyl phthalate	ND		15		ug/Kg	☼	02/02/15 10:53	02/02/15 18:03	1
Hexachlorobenzene	ND		7.6		ug/Kg	☼	02/02/15 10:53	02/02/15 18:03	1
N-Nitrosodiphenylamine	ND		7.6		ug/Kg	☼	02/02/15 10:53	02/02/15 18:03	1
Pentachlorophenol	ND		30		ug/Kg	☼	02/02/15 10:53	02/02/15 18:03	1
2,4-Dimethylphenol	ND		15		ug/Kg	☼	02/02/15 10:53	02/02/15 18:03	1
2-Methylphenol	ND		15		ug/Kg	☼	02/02/15 10:53	02/02/15 18:03	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
2,4,6-Tribromophenol (Surr)	63		28 - 143				02/02/15 10:53	02/02/15 18:03	1
2-Fluorobiphenyl	75		42 - 140				02/02/15 10:53	02/02/15 18:03	1
2-Fluorophenol (Surr)	84		36 - 145				02/02/15 10:53	02/02/15 18:03	1
Nitrobenzene-d5 (Surr)	72		38 - 141				02/02/15 10:53	02/02/15 18:03	1
Phenol-d5 (Surr)	80		38 - 149				02/02/15 10:53	02/02/15 18:03	1
Terphenyl-d14 (Surr)	91		42 - 151				02/02/15 10:53	02/02/15 18:03	1



# QC Sample Results

Client: Professional Service Industries (PSI)  
Project/Site: Cal-Portland Sand Cap Material

TestAmerica Job ID: 580-47190-2

## Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Lab Sample ID: MB 580-181505/1-A

Matrix: Solid

Analysis Batch: 181531

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 181505

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzoic acid	ND		380		ug/Kg		02/02/15 10:53	02/02/15 16:44	1
Benzyl alcohol	ND		15		ug/Kg		02/02/15 10:53	02/02/15 16:44	1
Diethyl phthalate	ND		30		ug/Kg		02/02/15 10:53	02/02/15 16:44	1
Dimethyl phthalate	ND		15		ug/Kg		02/02/15 10:53	02/02/15 16:44	1
Hexachlorobenzene	ND		7.5		ug/Kg		02/02/15 10:53	02/02/15 16:44	1
N-Nitrosodiphenylamine	ND		7.5		ug/Kg		02/02/15 10:53	02/02/15 16:44	1
Pentachlorophenol	ND		30		ug/Kg		02/02/15 10:53	02/02/15 16:44	1
2,4-Dimethylphenol	ND		15		ug/Kg		02/02/15 10:53	02/02/15 16:44	1
2-Methylphenol	ND		15		ug/Kg		02/02/15 10:53	02/02/15 16:44	1

Surrogate	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
2,4,6-Tribromophenol (Surr)	66		28 - 143	02/02/15 10:53	02/02/15 16:44	1
2-Fluorobiphenyl	82		42 - 140	02/02/15 10:53	02/02/15 16:44	1
2-Fluorophenol (Surr)	80		36 - 145	02/02/15 10:53	02/02/15 16:44	1
Nitrobenzene-d5 (Surr)	73		38 - 141	02/02/15 10:53	02/02/15 16:44	1
Phenol-d5 (Surr)	78		38 - 149	02/02/15 10:53	02/02/15 16:44	1
Terphenyl-d14 (Surr)	97		42 - 151	02/02/15 10:53	02/02/15 16:44	1

Lab Sample ID: LCS 580-181505/2-A

Matrix: Solid

Analysis Batch: 181531

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 181505

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Benzoic acid	400	304	J	ug/Kg		76	29 - 158
Benzyl alcohol	200	167		ug/Kg		83	55 - 123
Diethyl phthalate	200	194		ug/Kg		97	73 - 116
Dimethyl phthalate	200	188		ug/Kg		94	78 - 117
Hexachlorobenzene	200	198		ug/Kg		99	66 - 117
N-Nitrosodiphenylamine	200	179		ug/Kg		90	73 - 115
Pentachlorophenol	400	279		ug/Kg		70	45 - 117
2,4-Dimethylphenol	200	201		ug/Kg		100	54 - 139
2-Methylphenol	200	176		ug/Kg		88	71 - 116

Surrogate	LCS %Recovery	LCS Qualifier	Limits
2,4,6-Tribromophenol (Surr)	84		28 - 143
2-Fluorobiphenyl	87		42 - 140
2-Fluorophenol (Surr)	92		36 - 145
Nitrobenzene-d5 (Surr)	82		38 - 141
Phenol-d5 (Surr)	91		38 - 149
Terphenyl-d14 (Surr)	97		42 - 151

Lab Sample ID: LCSD 580-181505/3-A

Matrix: Solid

Analysis Batch: 181531

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 181505

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Benzoic acid	400	239	J	ug/Kg		60	29 - 158	24	28

TestAmerica Seattle

# QC Sample Results

Client: Professional Service Industries (PSI)  
Project/Site: Cal-Portland Sand Cap Material

TestAmerica Job ID: 580-47190-2

## Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: LCSD 580-181505/3-A

Matrix: Solid

Analysis Batch: 181531

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 181505

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Benzyl alcohol	200	155		ug/Kg		77	55 - 123	7	60
Diethyl phthalate	200	169		ug/Kg		85	73 - 116	14	26
Dimethyl phthalate	200	167		ug/Kg		83	78 - 117	12	30
Hexachlorobenzene	200	171		ug/Kg		86	66 - 117	15	30
N-Nitrosodiphenylamine	200	157		ug/Kg		79	73 - 115	13	30
Pentachlorophenol	400	229		ug/Kg		57	45 - 117	20	23
2,4-Dimethylphenol	200	171		ug/Kg		86	54 - 139	16	30
2-Methylphenol	200	159		ug/Kg		80	71 - 116	10	25

Surrogate	LCSD %Recovery	LCSD Qualifier	Limits
2,4,6-Tribromophenol (Surr)	70		28 - 143
2-Fluorobiphenyl	77		42 - 140
2-Fluorophenol (Surr)	86		36 - 145
Nitrobenzene-d5 (Surr)	78		38 - 141
Phenol-d5 (Surr)	81		38 - 149
Terphenyl-d14 (Surr)	88		42 - 151

Lab Chronicle

Client: Professional Service Industries (PSI)  
Project/Site: Cal-Portland Sand Cap Material

TestAmerica Job ID: 580-47190-2

**Client Sample ID: S1**  
**Date Collected: 01/26/15 11:00**  
**Date Received: 01/26/15 12:12**

**Lab Sample ID: 580-47190-1**  
**Matrix: Solid**  
**Percent Solids: 96.5**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3550B	RE		181505	02/02/15 10:53	RMB	TAL SEA
Total/NA	Analysis	8270D	RE	1	181531	02/02/15 18:03	EKK	TAL SEA

**Laboratory References:**  
TAL SEA = TestAmerica Seattle, 5755 8th Street East, Tacoma, WA 98424, TEL (253)922-2310

## Certification Summary

Client: Professional Service Industries (PSI)  
Project/Site: Cal-Portland Sand Cap Material

TestAmerica Job ID: 580-47190-2

### Laboratory: TestAmerica Seattle

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
Alaska (UST)	State Program	10	UST-022	03-04-15
L-A-B	DoD ELAP		L2236	01-19-16
L-A-B	ISO/IEC 17025		L2236	01-19-16
Montana (UST)	State Program	8	N/A	04-30-20
Oregon	NELAP	10	WA100007	11-06-15
US Fish & Wildlife	Federal		LE192332-0	02-28-16
USDA	Federal		P330-11-00222	04-08-17
Washington	State Program	10	C553	02-17-15



## Sample Summary

Client: Professional Service Industries (PSI)  
Project/Site: Cal-Portland Sand Cap Material

TestAmerica Job ID: 580-47190-2

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
580-47190-1	S1	Solid	01/26/15 11:00	01/26/15 12:12

1

2

3

4

5

6

7

8

9

10

11

THE LEADER IN ENVIRONMENTAL TESTING

☐ Rush  
☐ Short Hold[illegible]

Cooler	Possible Hazard Identification	Sample Disposal	<input type="checkbox"/> Disposal
<input type="checkbox"/> Yes <input type="checkbox"/> No   Cooler Temp: _____	<input type="checkbox"/> Non-Hazard <input type="checkbox"/> Flammable <input type="checkbox"/> Skin Irritant <input type="checkbox"/> Poison B <input type="checkbox"/> Unknown	<input type="checkbox"/> Return To Client	<input type="checkbox"/> Another

Turn Around Time Required (business days)

☐ 24 Hours    ☐ 48 Hours    ☐ 5 Days    ☐ 10 Days    ☐ 15 Days

QC Requirements (Specify)

1. Relinquished By Sign/Print

Date \_\_\_\_\_

Time

1. Received By Sign/Print

Fred, Leckie

1-2

10

1

## Login Sample Receipt Checklist

Client: Professional Service Industries (PSI)

Job Number: 580-47190-2

**Login Number: 47190**

**List Source: TestAmerica Seattle**

**List Number: 1**

**Creator: Blankinship, Tom X**

Question	Answer	Comment
Radioactivity wasn't checked or is $\leq$ background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	False	Refer to Job Narrative for details.
Cooler Temperature is acceptable.	False	Refer to Job Narrative for details.
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	False	Requested analyses are not listed on COC
Is the Field Sampler's name present on COC?	False	no
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is $<6\text{mm}$ (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	



January 30, 2015

Vernon Uy  
American Construction Co.  
1501 Taylor Way  
Tacoma, WA 98421

RE: Pre-testing of Activated Carbon Supplement Material  
Murray Morgan Bridge Channel Project  
RGA Job# R3157050

On January 26, 2014, Emily Kahler, Industrial Hygienist for RGA Environmental, a Terracon Company (RGA) collected samples of a Coconut Shell Activated Carbon (Product # OLC 12X40) material proposed for use as a supplement for "sand cap material" for the Murray Morgan Bridge Channel Project in Tacoma, Washington. The sampling event was conducted at American Construction's facility in Tacoma, Washington. Access to the American Construction Site was facilitated by Mr. Vernon Uy of American Construction who assisted obtained the sample of OLC 12X40 for evaluation.

#### BACKGROUND AND METHODOLOGIES

The OLC 12X40 product is proposed to be used as a supplement in the sand cap material to be used in the Murray Morgan Bridge Channel Project. RGA Environmental was retained to facilitate testing required in Section 02200 (D) 5-10 of the Project Specification. A one pound sample of OLC 12X40 was obtained by Mr. Uy, and provided to RGA for collection of the samples to be tested for the contaminants of concern (VOCs, SVOCs, priority pollutant metals, chlorinated pesticides, PCBs, and organic carbon). Samples for contaminants of concern were collected from the provided package in sampling bottles appropriate to the contaminant. See Table 1 for a summary of testing results, the full laboratory report is attached.

#### FINDINGS

Tables 1 through 5 below presents the results for analytical parameters from samples collected on January 26, 2015. All samples were analyzed by TestAmerica laboratory of Tacoma, Washington.

Results for all VOCs in the EPA 8260C panel were not detected, as was the QC surrogate added to the sample. This was a result of the activated carbon properties of the sample, and results were not reported in the laboratory report.

Table 1—Priority Pollutant Metals - EPA 6010/7470 (Results in mg/kg)

Analyte	Result	Analyte	Result
Antimony	<2.9	Nickel	<0.96
Arsenic	<2.9	Selenium	<4.8
Beryllium	<0.48	Silver	<2.4
Cadmium	<0.96	Thallium	<4.8
Chromium	<1.2	Zinc	<1.9
Copper	9.4	Mercury	<0.016
Lead	<1.4		



Table 2— Semi- Volatile Organic Compounds - EPA 8270D (Results in µg/kg)

Analyte	Result	Analyte	Result
1,2,4-Trichlorobenzene	48	Bis(2-chloroethoxy)methane	96
1,2-Dichlorobenzene	53	Bis(2-chloroethyl)ether	96
1,3-Dichlorobenzene	48	Bis(2-ethylhexyl) phthalate	580
1,4-Dichlorobenzene	48	bis(chloroisopropyl) ether	240
1-Methylnaphthalene	29	Butyl benzyl phthalate	190
2,4,5-Trichlorophenol	96	Carbazole	96
2,4,6-Trichlorophenol	140	Chrysene	24
2,4-Dichlorophenol	96	Dibenzofuran	96
2,4-Dimethylphenol	96	Diethyl phthalate	190
2,4-Dinitrophenol	960	Dimethyl phthalate	96
2,4-Dinitrotoluene	96	Di-n-butyl phthalate	480
2,6-Dinitrotoluene	96	Fluoranthene	19
2-Chloronaphthalene	19	Fluorene	19
2-Chlorophenol	96	Hexachlorobenzene	48
2-Methylnaphthalene	19	Hexachlorobutadiene	48
2-Methylphenol	96	Hexachlorocyclopentadiene	96
2-Nitroaniline	96	Hexachloroethane	96
2-Nitrophenol	96	Isophorone	96
3 & 4 Methylphenol	190	Naphthalene	19
3,3'-Dichlorobenzidine	190	Nitrobenzene	96
3-Nitroaniline	96	N-Nitrosodi-n-propylamine	96
4,6-Dinitro-2-methylphenol	960	N-Nitrosodiphenylamine	48
4-Bromophenyl phenyl ether	96	Pentachlorophenol	190
4-Chloro-3-methylphenol	96	Phenanthrene	19
4-Chloroaniline	96	Phenol	96
4-Chlorophenyl phenyl ether	96	Pyrene	19
4-Nitroaniline	96	Benzo[a]pyrene	<290
4-Nitrophenol	960	Benzo[b]fluoranthene	<190
Acenaphthene	19	Benzo[g,h,i]perylene	<240
Acenaphthylene	19	Benzo[k]fluoranthene	<240
Anthracene	19	Dibenz(a,h)anthracene	<380
Benzo[a]anthracene	19	Di-n-octyl phthalate	<4800
Benzoic acid	2400	Indeno[1,2,3-cd]pyrene	<380
Benzyl alcohol	96		

Table 3— Chlorinated Pesticides - EPA 8081 (Results in µg/kg)

Analyte	Result	Analyte	Result
Aldrin	1.0	Endosulfan sulfate	2.0
alpha-BHC	1.0	Endrin	2.0
beta-BHC	1.0	Endrin aldehyde	2.0
delta-BHC	1.0	Heptachlor	2.0
gamma-BHC (Lindane)	1.0	Heptachlor epoxide	1.0
4,4'-DDD	2.0	Methoxychlor	10
4,4'-DDE	2.0	Endrin ketone	2.0
4,4'-DDT	2.0	Toxaphene	100
Dieldrin	2.0	alpha-Chlordane	1.0
Endosulfan I	1.0	gamma-Chlordane	1.0
Endosulfan II	2.0		

Table 4— Polychlorinated Biphenyls - EPA 8082 (Results in mg/kg)

Analyte	Result
PCB-1221	<0.011
PCB-1232	<0.011
PCB-1242	<0.010
PCB-1248	<0.010
PCB-1254	<0.010
PCB-1260	<0.010
Polychlorinated biphenyls, Total	<0.091

Table 5— Total Organic Carbon - EPA 9060 (Results in mg/kg)

Analyte	Result
Total Organic Carbon	940,000

#### LIMITS OF SURVEY

This report does not represent all conditions at the subject site as it only reflects the information gathered from specific locations. Observation or sampling of other work areas was not within the scope of RGA's work and was not performed.

This report was prepared pursuant to the contract RGA has with the client. Unauthorized reliance on or use of this report, including any of its information or conclusions, will be at third party's risk. For the same reasons, no warranties or representations, expressed or implied in this report, are made to any such third party.

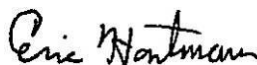
Contact us at 206-281-8858 with any questions.

Report Prepared by,



Emily Kahler  
Industrial Hygienist  
RGA Environmental, a Terracon Company

Report Reviewed by,



Eric Hartman, CIH  
Senior Project Manager  
RGA Environmental, a Terracon Company

Attachments:

*Lab Report*

# TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

## ANALYTICAL REPORT

TestAmerica Laboratories, Inc.

TestAmerica Seattle  
5755 8th Street East  
Tacoma, WA 98424  
Tel: (253)922-2310

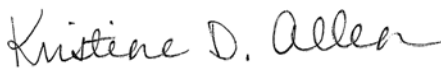
TestAmerica Job ID: 580-47198-1

Client Project/Site: Fill Soil Test R3157050

For:

RGA Environmental, Inc.  
a Terracon Company  
3317 3rd Ave South  
Suite D  
Seattle, Washington 98134

Attn: Heather Binuya



Authorized for release by:  
1/30/2015 3:56:02 PM

Kristine Allen, Manager of Project Management  
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[kristine.allen@testamericainc.com](mailto:kristine.allen@testamericainc.com)

### LINKS

Review your project  
results through  
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Have a Question?



Visit us at:  
[www.testamericainc.com](http://www.testamericainc.com)

*This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.*

*Results relate only to the items tested and the sample(s) as received by the laboratory.*



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## Case Narrative

Client: RGA Environmental, Inc.  
Project/Site: Fill Soil Test R3157050

TestAmerica Job ID: 580-47198-1

**Job ID: 580-47198-1**

**Laboratory: TestAmerica Seattle**

### Narrative

#### Receipt

The sample was received on 1/26/2015 3:15 PM; the sample arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 10.5° C.

Except:

The 4oz bulk containers for sample 7050-01 (580-47198-1) lack labels and only the ID is written on the lids. The sample is logged in per chain of custody.

Volatile containers were requested on the bottle order and received for sample 7050-01 (580-47198-1) however, volatile analysis was not requested on the Chain of Custody (COC).

The client cancelled the 8260 analysis due to matrix issues.

#### GC/MS Semi VOA

Method(s) 8270D: The continuing calibration verification (CCV) associated with batch 181353 recovered outside acceptance criteria, low biased relative response factor (RRF), for 2,4-Dimethylphenol, 4-Chloro-3-methylphenol, Bis(2-chloroethoxy)methane, Isophorone, Nitrobenzene and N-Nitrosodi-n-propylamine. These six targets have been identified as poor performers by 8270D criteria based on RRF's observed in instrument calibrations. It should be noted that RRF criteria is only a measure of instrument responsiveness and not system accuracy: all targets including these poor performers passed the +/-20% recovery criteria in the CCV. A reporting limit (RL) standard was analyzed, and the target analytes were detected demonstrating adequate sensitivity. Since the associated samples were non-detect for this analyte, the data have been reported.

Method(s) 8270D: Surrogate recovery for 7050-01 (580-47198-1) was outside control limits. Chromatographic evidence of matrix interference is present; therefore, re-extraction and/or re-analysis was not performed.

Method(s) 8270D: The following sample was diluted due to the nature of the sample matrix: 7050-01 (580-47198-1). Elevated reporting limits (RLs) are provided.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

#### GC Semi VOA

Method(s) 8081B: In analysis batch 181382, surrogate recoveries of Tetrachloro-m-xylene (TCMX) and Decachlorobiphenyl (DCB) for the following sample was outside control limits: 7050-01 (580-47198-1). Evidence of matrix interference is present, as this sample is carbon particles, which is used to absorb organic compounds/analytes; therefore, re-extraction and/or re-analysis was not performed.

Method(s) 8082A: In analysis batch 181384, surrogate recoveries of Tetrachloro-m-xylene (TCMX) and Decachlorobiphenyl (DCB) for the following sample was outside control limits: 7050-01 (580-47198-1). Evidence of matrix interference is present, as this sample is carbon particles, which is used to absorb organic compounds/analytes; therefore, re-extraction and/or re-analysis was not performed.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

#### Metals

Method(s) 6010C: The low level continuing calibration verification (CCVL) associated with batch 181181 recovered above the upper control limit for Pb. The samples associated with this CCVL were non-detects for the affected analytes; therefore, the data have been reported.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

#### General Chemistry

No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

#### Organic Prep

No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

## Definitions/Glossary

Client: RGA Environmental, Inc.  
Project/Site: Fill Soil Test R3157050

TestAmerica Job ID: 580-47198-1

### Qualifiers

#### GC/MS Semi VOA

Qualifier	Qualifier Description
X	Surrogate is outside control limits
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

#### GC Semi VOA

Qualifier	Qualifier Description
X	Surrogate is outside control limits

#### Metals

Qualifier	Qualifier Description
^	ICV,CCV,ICB,CCB, ISA, ISB, CRI, CRA, DLCK or MRL standard: Instrument related QC exceeds the control limits.

### Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
□	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

# Client Sample Results

Client: RGA Environmental, Inc.  
Project/Site: Fill Soil Test R3157050

TestAmerica Job ID: 580-47198-1

**Client Sample ID: 7050-01**

**Lab Sample ID: 580-47198-1**

**Date Collected: 01/26/15 14:50**

**Matrix: Solid**

**Date Received: 01/26/15 15:15**

**Percent Solids: 96.6**

## Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2,4-Trichlorobenzene	ND		48		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
1,2-Dichlorobenzene	ND		53		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
1,3-Dichlorobenzene	ND		48		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
1,4-Dichlorobenzene	ND		48		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
1-Methylnaphthalene	ND		29		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
2,4,5-Trichlorophenol	ND		96		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
2,4,6-Trichlorophenol	ND		140		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
2,4-Dichlorophenol	ND		96		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
2,4-Dimethylphenol	ND		96		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
2,4-Dinitrophenol	ND		960		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
2,4-Dinitrotoluene	ND		96		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
2,6-Dinitrotoluene	ND		96		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
2-Chloronaphthalene	ND		19		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
2-Chlorophenol	ND		96		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
2-Methylnaphthalene	ND		19		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
2-Methylphenol	ND		96		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
2-Nitroaniline	ND		96		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
2-Nitrophenol	ND		96		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
3 & 4 Methylphenol	ND		190		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
3,3'-Dichlorobenzidine	ND		190		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
3-Nitroaniline	ND		96		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
4,6-Dinitro-2-methylphenol	ND		960		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
4-Bromophenyl phenyl ether	ND		96		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
4-Chloro-3-methylphenol	ND		96		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
4-Chloroaniline	ND		96		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
4-Chlorophenyl phenyl ether	ND		96		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
4-Nitroaniline	ND		96		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
4-Nitrophenol	ND		960		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
Acenaphthene	ND		19		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
Acenaphthylene	ND		19		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
Anthracene	ND		19		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
Benzo[a]anthracene	ND		19		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
Benzoic acid	ND		2400		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
Benzyl alcohol	ND		96		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
Bis(2-chloroethoxy)methane	ND		96		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
Bis(2-chloroethyl)ether	ND		96		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
Bis(2-ethylhexyl) phthalate	ND		580		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
bis(chloroisopropyl) ether	ND		240		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
Butyl benzyl phthalate	ND		190		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
Carbazole	ND		96		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
Chrysene	ND		24		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
Dibenzofuran	ND		96		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
Diethyl phthalate	ND		190		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
Dimethyl phthalate	ND		96		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
Di-n-butyl phthalate	ND		480		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
Fluoranthene	ND		19		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
Fluorene	ND		19		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
Hexachlorobenzene	ND		48		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
Hexachlorobutadiene	ND		48		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1

TestAmerica Seattle

# Client Sample Results

Client: RGA Environmental, Inc.  
Project/Site: Fill Soil Test R3157050

TestAmerica Job ID: 580-47198-1

**Client Sample ID: 7050-01**

**Lab Sample ID: 580-47198-1**

**Date Collected: 01/26/15 14:50**

**Matrix: Solid**

**Date Received: 01/26/15 15:15**

**Percent Solids: 96.6**

## Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Hexachlorocyclopentadiene	ND		96		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
Hexachloroethane	ND		96		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
Isophorone	ND		96		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
Naphthalene	ND		19		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
Nitrobenzene	ND		96		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
N-Nitrosodi-n-propylamine	ND		96		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
N-Nitrosodiphenylamine	ND		48		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
Pentachlorophenol	ND		190		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
Phenanthrene	ND		19		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
Phenol	ND		96		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1
Pyrene	ND		19		ug/Kg	☼	01/29/15 14:23	01/30/15 12:50	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
2,4,6-Tribromophenol (Surr)	0	X	28 - 143	01/29/15 14:23	01/30/15 12:50	1
2-Fluorobiphenyl	2	X	42 - 140	01/29/15 14:23	01/30/15 12:50	1
2-Fluorophenol (Surr)	5	X	36 - 145	01/29/15 14:23	01/30/15 12:50	1
Nitrobenzene-d5 (Surr)	7	X	38 - 141	01/29/15 14:23	01/30/15 12:50	1
Phenol-d5 (Surr)	10	X	38 - 149	01/29/15 14:23	01/30/15 12:50	1
Terphenyl-d14 (Surr)	0	X	42 - 151	01/29/15 14:23	01/30/15 12:50	1

## Method: 8270D - Semivolatile Organic Compounds (GC/MS) - DL

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzo[a]pyrene	ND		290		ug/Kg	☼	01/29/15 14:23	01/30/15 11:48	10
Benzo[b]fluoranthene	ND		190		ug/Kg	☼	01/29/15 14:23	01/30/15 11:48	10
Benzo[g,h,i]perylene	ND		240		ug/Kg	☼	01/29/15 14:23	01/30/15 11:48	10
Benzo[k]fluoranthene	ND		240		ug/Kg	☼	01/29/15 14:23	01/30/15 11:48	10
Dibenz(a,h)anthracene	ND		380		ug/Kg	☼	01/29/15 14:23	01/30/15 11:48	10
Di-n-octyl phthalate	ND		4800		ug/Kg	☼	01/29/15 14:23	01/30/15 11:48	10
Indeno[1,2,3-cd]pyrene	ND		380		ug/Kg	☼	01/29/15 14:23	01/30/15 11:48	10

## Method: 8081B - Organochlorine Pesticides (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aldrin	ND		1.0		ug/Kg	☼	01/29/15 14:56	01/30/15 11:16	1
alpha-BHC	ND		1.0		ug/Kg	☼	01/29/15 14:56	01/30/15 11:16	1
beta-BHC	ND		1.0		ug/Kg	☼	01/29/15 14:56	01/30/15 11:16	1
delta-BHC	ND		1.0		ug/Kg	☼	01/29/15 14:56	01/30/15 11:16	1
gamma-BHC (Lindane)	ND		1.0		ug/Kg	☼	01/29/15 14:56	01/30/15 11:16	1
4,4'-DDD	ND		2.0		ug/Kg	☼	01/29/15 14:56	01/30/15 11:16	1
4,4'-DDE	ND		2.0		ug/Kg	☼	01/29/15 14:56	01/30/15 11:16	1
4,4'-DDT	ND		2.0		ug/Kg	☼	01/29/15 14:56	01/30/15 11:16	1
Dieldrin	ND		2.0		ug/Kg	☼	01/29/15 14:56	01/30/15 11:16	1
Endosulfan I	ND		1.0		ug/Kg	☼	01/29/15 14:56	01/30/15 11:16	1
Endosulfan II	ND		2.0		ug/Kg	☼	01/29/15 14:56	01/30/15 11:16	1
Endosulfan sulfate	ND		2.0		ug/Kg	☼	01/29/15 14:56	01/30/15 11:16	1
Endrin	ND		2.0		ug/Kg	☼	01/29/15 14:56	01/30/15 11:16	1
Endrin aldehyde	ND		2.0		ug/Kg	☼	01/29/15 14:56	01/30/15 11:16	1
Heptachlor	ND		2.0		ug/Kg	☼	01/29/15 14:56	01/30/15 11:16	1
Heptachlor epoxide	ND		1.0		ug/Kg	☼	01/29/15 14:56	01/30/15 11:16	1
Methoxychlor	ND		10		ug/Kg	☼	01/29/15 14:56	01/30/15 11:16	1
Endrin ketone	ND		2.0		ug/Kg	☼	01/29/15 14:56	01/30/15 11:16	1

TestAmerica Seattle



# Client Sample Results

Client: RGA Environmental, Inc.  
Project/Site: Fill Soil Test R3157050

TestAmerica Job ID: 580-47198-1

**Client Sample ID: 7050-01**

**Lab Sample ID: 580-47198-1**

**Date Collected: 01/26/15 14:50**

**Matrix: Solid**

**Date Received: 01/26/15 15:15**

**Percent Solids: 96.6**

## Method: 8081B - Organochlorine Pesticides (GC) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Toxaphene	ND		100		ug/Kg	☼	01/29/15 14:56	01/30/15 11:16	1
alpha-Chlordane	ND		1.0		ug/Kg	☼	01/29/15 14:56	01/30/15 11:16	1
gamma-Chlordane	ND		1.0		ug/Kg	☼	01/29/15 14:56	01/30/15 11:16	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
Tetrachloro-m-xylene	0.9	X	35 - 129				01/29/15 14:56	01/30/15 11:16	1
DCB Decachlorobiphenyl	32	X	60 - 128				01/29/15 14:56	01/30/15 11:16	1

## Method: 8082A - Polychlorinated Biphenyls (PCBs) by Gas Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
PCB-1016	ND		0.010		mg/Kg	☼	01/29/15 14:56	01/30/15 11:34	1
PCB-1221	ND		0.011		mg/Kg	☼	01/29/15 14:56	01/30/15 11:34	1
PCB-1232	ND		0.011		mg/Kg	☼	01/29/15 14:56	01/30/15 11:34	1
PCB-1242	ND		0.010		mg/Kg	☼	01/29/15 14:56	01/30/15 11:34	1
PCB-1248	ND		0.010		mg/Kg	☼	01/29/15 14:56	01/30/15 11:34	1
PCB-1254	ND		0.010		mg/Kg	☼	01/29/15 14:56	01/30/15 11:34	1
PCB-1260	ND		0.010		mg/Kg	☼	01/29/15 14:56	01/30/15 11:34	1
Polychlorinated biphenyls, Total	ND		0.091		mg/Kg	☼	01/29/15 14:56	01/30/15 11:34	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
DCB Decachlorobiphenyl	42	X	50 - 140				01/29/15 14:56	01/30/15 11:34	1
Tetrachloro-m-xylene	0.8	X	45 - 135				01/29/15 14:56	01/30/15 11:34	1

## Method: 6010C - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		2.9		mg/Kg	☼	01/27/15 15:51	01/28/15 07:15	1
Antimony	ND		2.9		mg/Kg	☼	01/27/15 15:51	01/28/15 07:15	1
Beryllium	ND		0.48		mg/Kg	☼	01/27/15 15:51	01/28/15 07:15	1
Cadmium	ND		0.96		mg/Kg	☼	01/27/15 15:51	01/28/15 07:15	1
Chromium	ND		1.2		mg/Kg	☼	01/27/15 15:51	01/28/15 07:15	1
Copper	9.4		1.4		mg/Kg	☼	01/27/15 15:51	01/28/15 07:15	1
Lead	ND	^	1.4		mg/Kg	☼	01/27/15 15:51	01/28/15 07:15	1
Nickel	ND		0.96		mg/Kg	☼	01/27/15 15:51	01/28/15 07:15	1
Selenium	ND		4.8		mg/Kg	☼	01/27/15 15:51	01/28/15 07:15	1
Silver	ND		2.4		mg/Kg	☼	01/27/15 15:51	01/28/15 07:15	1
Thallium	ND		4.8		mg/Kg	☼	01/27/15 15:51	01/28/15 07:15	1
Zinc	ND		1.9		mg/Kg	☼	01/27/15 15:51	01/28/15 07:15	1

## Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.016		mg/Kg	☼	01/27/15 10:00	01/27/15 12:29	1

## General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Organic Carbon	940000		2000		mg/Kg			01/29/15 09:45	1
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	97		0.10		%			01/28/15 16:50	1
Percent Moisture	3.4		0.10		%			01/28/15 16:50	1

TestAmerica Seattle

# QC Sample Results

Client: RGA Environmental, Inc.  
Project/Site: Fill Soil Test R3157050

TestAmerica Job ID: 580-47198-1

## Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Lab Sample ID: MB 580-181341/1-A

Matrix: Solid

Analysis Batch: 181353

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 181341

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2,4-Trichlorobenzene	ND		50		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
1,2-Dichlorobenzene	ND		55		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
1,3-Dichlorobenzene	ND		50		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
1,4-Dichlorobenzene	ND		50		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
1-Methylnaphthalene	ND		30		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
2,4,5-Trichlorophenol	ND		100		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
2,4,6-Trichlorophenol	ND		150		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
2,4-Dichlorophenol	ND		100		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
2,4-Dimethylphenol	ND		100		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
2,4-Dinitrophenol	ND		1000		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
2,4-Dinitrotoluene	ND		100		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
2,6-Dinitrotoluene	ND		100		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
2-Chloronaphthalene	ND		20		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
2-Chlorophenol	ND		100		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
2-Methylnaphthalene	ND		20		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
2-Methylphenol	ND		100		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
2-Nitroaniline	ND		100		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
2-Nitrophenol	ND		100		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
3 & 4 Methylphenol	ND		200		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
3,3'-Dichlorobenzidine	ND		200		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
3-Nitroaniline	ND		100		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
4,6-Dinitro-2-methylphenol	ND		1000		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
4-Bromophenyl phenyl ether	ND		100		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
4-Chloro-3-methylphenol	ND		100		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
4-Chloroaniline	ND		100		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
4-Chlorophenyl phenyl ether	ND		100		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
4-Nitroaniline	ND		100		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
4-Nitrophenol	ND		1000		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
Acenaphthene	ND		20		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
Acenaphthylene	ND		20		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
Anthracene	ND		20		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
Benzo[a]anthracene	ND		20		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
Benzo[a]pyrene	ND		30		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
Benzo[b]fluoranthene	ND		20		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
Benzo[g,h,i]perylene	ND		25		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
Benzo[k]fluoranthene	ND		25		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
Benzoic acid	ND		2500		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
Benzyl alcohol	ND		100		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
Bis(2-chloroethoxy)methane	ND		100		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
Bis(2-chloroethyl)ether	ND		100		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
Bis(2-ethylhexyl) phthalate	ND		600		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
bis(chloroisopropyl) ether	ND		250		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
Butyl benzyl phthalate	ND		200		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
Carbazole	ND		100		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
Chrysene	ND		25		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
Dibenz(a,h)anthracene	ND		40		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
Dibenzofuran	ND		100		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
Diethyl phthalate	ND		200		ug/Kg		01/29/15 14:23	01/29/15 18:41	1

TestAmerica Seattle

# QC Sample Results

Client: RGA Environmental, Inc.  
Project/Site: Fill Soil Test R3157050

TestAmerica Job ID: 580-47198-1

## Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: MB 580-181341/1-A

Matrix: Solid

Analysis Batch: 181353

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 181341

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Dimethyl phthalate	ND		100		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
Di-n-butyl phthalate	ND		500		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
Di-n-octyl phthalate	ND		500		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
Fluoranthene	ND		20		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
Fluorene	ND		20		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
Hexachlorobenzene	ND		50		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
Hexachlorobutadiene	ND		50		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
Hexachlorocyclopentadiene	ND		100		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
Hexachloroethane	ND		100		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
Indeno[1,2,3-cd]pyrene	ND		40		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
Isophorone	ND		100		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
Naphthalene	ND		20		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
Nitrobenzene	ND		100		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
N-Nitrosodi-n-propylamine	ND		100		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
N-Nitrosodiphenylamine	ND		50		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
Pentachlorophenol	ND		200		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
Phenanthrene	ND		20		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
Phenol	ND		100		ug/Kg		01/29/15 14:23	01/29/15 18:41	1
Pyrene	ND		20		ug/Kg		01/29/15 14:23	01/29/15 18:41	1

Surrogate	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
2,4,6-Tribromophenol (Surr)	58		28 - 143	01/29/15 14:23	01/29/15 18:41	1
2-Fluorobiphenyl	87		42 - 140	01/29/15 14:23	01/29/15 18:41	1
2-Fluorophenol (Surr)	93		36 - 145	01/29/15 14:23	01/29/15 18:41	1
Nitrobenzene-d5 (Surr)	75		38 - 141	01/29/15 14:23	01/29/15 18:41	1
Phenol-d5 (Surr)	89		38 - 149	01/29/15 14:23	01/29/15 18:41	1
Terphenyl-d14 (Surr)	88		42 - 151	01/29/15 14:23	01/29/15 18:41	1

Lab Sample ID: LCS 580-181341/2-A

Matrix: Solid

Analysis Batch: 181353

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 181341

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,2,4-Trichlorobenzene	1000	955		ug/Kg		96	66 - 115
1,2-Dichlorobenzene	1000	979		ug/Kg		98	64 - 112
1,3-Dichlorobenzene	1000	962		ug/Kg		96	64 - 111
1,4-Dichlorobenzene	1000	932		ug/Kg		93	65 - 110
1-Methylnaphthalene	1000	943		ug/Kg		94	62 - 118
2,4,5-Trichlorophenol	1000	955		ug/Kg		96	57 - 133
2,4,6-Trichlorophenol	1000	901		ug/Kg		90	62 - 133
2,4-Dichlorophenol	1000	977		ug/Kg		98	68 - 125
2,4-Dimethylphenol	1000	1010		ug/Kg		101	54 - 139
2,4-Dinitrophenol	2000	1270		ug/Kg		63	20 - 141
2,4-Dinitrotoluene	1000	843		ug/Kg		84	68 - 121
2,6-Dinitrotoluene	1000	894		ug/Kg		89	66 - 123
2-Chloronaphthalene	1000	973		ug/Kg		97	68 - 112
2-Chlorophenol	1000	920		ug/Kg		92	68 - 117
2-Methylnaphthalene	1000	931		ug/Kg		93	64 - 119

TestAmerica Seattle

# QC Sample Results

Client: RGA Environmental, Inc.  
Project/Site: Fill Soil Test R3157050

TestAmerica Job ID: 580-47198-1

## Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: LCS 580-181341/2-A

Matrix: Solid

Analysis Batch: 181353

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 181341

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
2-Methylphenol	1000	923		ug/Kg		92	71 - 116
2-Nitroaniline	1000	899		ug/Kg		90	64 - 112
2-Nitrophenol	1000	863		ug/Kg		86	67 - 127
3 & 4 Methylphenol	1000	1040		ug/Kg		104	70 - 116
3,3'-Dichlorobenzidine	2000	1310		ug/Kg		66	20 - 103
3-Nitroaniline	1000	665		ug/Kg		67	27 - 103
4,6-Dinitro-2-methylphenol	2000	1500		ug/Kg		75	48 - 130
4-Bromophenyl phenyl ether	1000	959		ug/Kg		96	68 - 122
4-Chloro-3-methylphenol	1000	943		ug/Kg		94	69 - 121
4-Chloroaniline	1000	460		ug/Kg		46	20 - 103
4-Chlorophenyl phenyl ether	1000	932		ug/Kg		93	75 - 108
4-Nitroaniline	1000	844		ug/Kg		84	58 - 108
4-Nitrophenol	2000	1700		ug/Kg		85	20 - 165
Acenaphthene	1000	962		ug/Kg		96	68 - 116
Acenaphthylene	1000	908		ug/Kg		91	68 - 120
Anthracene	1000	929		ug/Kg		93	73 - 116
Benzo[a]anthracene	1000	902		ug/Kg		90	76 - 119
Benzo[a]pyrene	1000	887		ug/Kg		89	72 - 117
Benzo[b]fluoranthene	1000	933		ug/Kg		93	63 - 132
Benzo[g,h,i]perylene	1000	906		ug/Kg		91	55 - 139
Benzo[k]fluoranthene	1000	951		ug/Kg		95	63 - 119
Benzoic acid	2000	1520	J	ug/Kg		76	29 - 158
Benzyl alcohol	1000	868		ug/Kg		87	55 - 123
Bis(2-chloroethoxy)methane	1000	862		ug/Kg		86	69 - 107
Bis(2-chloroethyl)ether	1000	886		ug/Kg		89	62 - 110
Bis(2-ethylhexyl) phthalate	1000	892		ug/Kg		89	62 - 144
bis(chloroisopropyl) ether	1000	900		ug/Kg		90	41 - 126
Butyl benzyl phthalate	1000	868		ug/Kg		87	69 - 142
Carbazole	1000	1000		ug/Kg		100	76 - 135
Chrysene	1000	1070		ug/Kg		107	75 - 114
Dibenz(a,h)anthracene	1000	912		ug/Kg		91	56 - 134
Dibenzofuran	1000	924		ug/Kg		92	72 - 109
Diethyl phthalate	1000	894		ug/Kg		89	73 - 116
Dimethyl phthalate	1000	927		ug/Kg		93	78 - 117
Di-n-butyl phthalate	1000	831		ug/Kg		83	66 - 140
Di-n-octyl phthalate	1000	754		ug/Kg		75	65 - 141
Fluoranthene	1000	935		ug/Kg		94	73 - 125
Fluorene	1000	954		ug/Kg		95	70 - 121
Hexachlorobenzene	1000	1030		ug/Kg		103	66 - 117
Hexachlorobutadiene	1000	912		ug/Kg		91	65 - 116
Hexachlorocyclopentadiene	1000	915		ug/Kg		92	46 - 131
Hexachloroethane	1000	870		ug/Kg		87	62 - 120
Indeno[1,2,3-cd]pyrene	1000	881		ug/Kg		88	56 - 127
Isophorone	1000	926		ug/Kg		93	67 - 119
Naphthalene	1000	958		ug/Kg		96	62 - 112
Nitrobenzene	1000	870		ug/Kg		87	64 - 118
N-Nitrosodi-n-propylamine	1000	967		ug/Kg		97	62 - 116
N-Nitrosodiphenylamine	1000	880		ug/Kg		88	73 - 115

TestAmerica Seattle



# QC Sample Results

Client: RGA Environmental, Inc.  
Project/Site: Fill Soil Test R3157050

TestAmerica Job ID: 580-47198-1

## Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: LCS 580-181341/2-A

Matrix: Solid

Analysis Batch: 181353

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 181341

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Pentachlorophenol	2000	1490		ug/Kg		74	45 - 117
Phenanthrene	1000	970		ug/Kg		97	73 - 106
Phenol	1000	976		ug/Kg		98	63 - 111
Pyrene	1000	920		ug/Kg		92	70 - 120

Surrogate	LCS %Recovery	LCS Qualifier	Limits
2,4,6-Tribromophenol (Surr)	79		28 - 143
2-Fluorobiphenyl	87		42 - 140
2-Fluorophenol (Surr)	95		36 - 145
Nitrobenzene-d5 (Surr)	82		38 - 141
Phenol-d5 (Surr)	94		38 - 149
Terphenyl-d14 (Surr)	86		42 - 151

Lab Sample ID: LCSD 580-181341/3-A

Matrix: Solid

Analysis Batch: 181353

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 181341

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
1,2,4-Trichlorobenzene	1000	948		ug/Kg		95	66 - 115	1	28
1,2-Dichlorobenzene	1000	1040		ug/Kg		104	64 - 112	6	30
1,3-Dichlorobenzene	1000	986		ug/Kg		99	64 - 111	2	30
1,4-Dichlorobenzene	1000	985		ug/Kg		99	65 - 110	6	30
1-Methylnaphthalene	1000	969		ug/Kg		97	62 - 118	3	30
2,4,5-Trichlorophenol	1000	948		ug/Kg		95	57 - 133	1	30
2,4,6-Trichlorophenol	1000	923		ug/Kg		92	62 - 133	2	30
2,4-Dichlorophenol	1000	990		ug/Kg		99	68 - 125	1	30
2,4-Dimethylphenol	1000	1070		ug/Kg		107	54 - 139	6	30
2,4-Dinitrophenol	2000	1610		ug/Kg		80	20 - 141	24	36
2,4-Dinitrotoluene	1000	865		ug/Kg		87	68 - 121	3	30
2,6-Dinitrotoluene	1000	901		ug/Kg		90	66 - 123	1	30
2-Chloronaphthalene	1000	947		ug/Kg		95	68 - 112	3	25
2-Chlorophenol	1000	1010		ug/Kg		101	68 - 117	9	27
2-Methylnaphthalene	1000	972		ug/Kg		97	64 - 119	4	27
2-Methylphenol	1000	954		ug/Kg		95	71 - 116	3	25
2-Nitroaniline	1000	819		ug/Kg		82	64 - 112	9	22
2-Nitrophenol	1000	966		ug/Kg		97	67 - 127	11	30
3 & 4 Methylphenol	1000	1060		ug/Kg		106	70 - 116	2	27
3,3'-Dichlorobenzidine	2000	1480		ug/Kg		74	20 - 103	12	60
3-Nitroaniline	1000	727		ug/Kg		73	27 - 103	9	33
4,6-Dinitro-2-methylphenol	2000	1630		ug/Kg		81	48 - 130	8	22
4-Bromophenyl phenyl ether	1000	980		ug/Kg		98	68 - 122	2	30
4-Chloro-3-methylphenol	1000	947		ug/Kg		95	69 - 121	0	27
4-Chloroaniline	1000	689		ug/Kg		69	20 - 103	40	60
4-Chlorophenyl phenyl ether	1000	997		ug/Kg		100	75 - 108	7	30
4-Nitroaniline	1000	891		ug/Kg		89	58 - 108	5	32
4-Nitrophenol	2000	1650		ug/Kg		82	20 - 165	3	30
Acenaphthene	1000	984		ug/Kg		98	68 - 116	2	27
Acenaphthylene	1000	891		ug/Kg		89	68 - 120	2	28

TestAmerica Seattle

# QC Sample Results

Client: RGA Environmental, Inc.  
Project/Site: Fill Soil Test R3157050

TestAmerica Job ID: 580-47198-1

## Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: LCSD 580-181341/3-A

Matrix: Solid

Analysis Batch: 181353

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 181341

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Anthracene	1000	922		ug/Kg		92	73 - 116	1	27
Benzo[a]anthracene	1000	879		ug/Kg		88	76 - 119	3	27
Benzo[a]pyrene	1000	905		ug/Kg		90	72 - 117	2	30
Benzo[b]fluoranthene	1000	868		ug/Kg		87	63 - 132	7	30
Benzo[g,h,i]perylene	1000	949		ug/Kg		95	55 - 139	5	28
Benzo[k]fluoranthene	1000	1050		ug/Kg		105	63 - 119	10	30
Benzoic acid	2000	1660	J	ug/Kg		83	29 - 158	9	28
Benzyl alcohol	1000	873		ug/Kg		87	55 - 123	1	60
Bis(2-chloroethoxy)methane	1000	913		ug/Kg		91	69 - 107	6	30
Bis(2-chloroethyl)ether	1000	973		ug/Kg		97	62 - 110	9	22
Bis(2-ethylhexyl) phthalate	1000	872		ug/Kg		87	62 - 144	2	30
bis(chloroisopropyl) ether	1000	978		ug/Kg		98	41 - 126	8	57
Butyl benzyl phthalate	1000	831		ug/Kg		83	69 - 142	4	30
Carbazole	1000	1010		ug/Kg		101	76 - 135	0	30
Chrysene	1000	1060		ug/Kg		106	75 - 114	1	26
Dibenz(a,h)anthracene	1000	1020		ug/Kg		102	56 - 134	11	30
Dibenzofuran	1000	974		ug/Kg		97	72 - 109	5	30
Diethyl phthalate	1000	897		ug/Kg		90	73 - 116	0	26
Dimethyl phthalate	1000	929		ug/Kg		93	78 - 117	0	30
Di-n-butyl phthalate	1000	837		ug/Kg		84	66 - 140	1	30
Di-n-octyl phthalate	1000	732		ug/Kg		73	65 - 141	3	30
Fluoranthene	1000	896		ug/Kg		90	73 - 125	4	30
Fluorene	1000	980		ug/Kg		98	70 - 121	3	30
Hexachlorobenzene	1000	990		ug/Kg		99	66 - 117	4	30
Hexachlorobutadiene	1000	994		ug/Kg		99	65 - 116	9	30
Hexachlorocyclopentadiene	1000	955		ug/Kg		96	46 - 131	4	29
Hexachloroethane	1000	916		ug/Kg		92	62 - 120	5	30
Indeno[1,2,3-cd]pyrene	1000	882		ug/Kg		88	56 - 127	0	29
Isophorone	1000	988		ug/Kg		99	67 - 119	6	30
Naphthalene	1000	967		ug/Kg		97	62 - 112	1	26
Nitrobenzene	1000	826		ug/Kg		83	64 - 118	5	30
N-Nitrosodi-n-propylamine	1000	955		ug/Kg		96	62 - 116	1	28
N-Nitrosodiphenylamine	1000	857		ug/Kg		86	73 - 115	3	30
Pentachlorophenol	2000	1530		ug/Kg		77	45 - 117	3	23
Phenanthrene	1000	944		ug/Kg		94	73 - 106	3	28
Phenol	1000	993		ug/Kg		99	63 - 111	2	26
Pyrene	1000	911		ug/Kg		91	70 - 120	1	30

Surrogate	LCSD %Recovery	LCSD Qualifier	Limits
2,4,6-Tribromophenol (Surr)	76		28 - 143
2-Fluorobiphenyl	86		42 - 140
2-Fluorophenol (Surr)	99		36 - 145
Nitrobenzene-d5 (Surr)	77		38 - 141
Phenol-d5 (Surr)	96		38 - 149
Terphenyl-d14 (Surr)	84		42 - 151

TestAmerica Seattle

# QC Sample Results

Client: RGA Environmental, Inc.  
Project/Site: Fill Soil Test R3157050

TestAmerica Job ID: 580-47198-1

## Method: 8081B - Organochlorine Pesticides (GC)

Lab Sample ID: MB 580-181345/1-A

Matrix: Solid

Analysis Batch: 181382

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 181345

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aldrin	ND		1.0		ug/Kg		01/29/15 14:56	01/30/15 09:36	1
alpha-BHC	ND		1.0		ug/Kg		01/29/15 14:56	01/30/15 09:36	1
beta-BHC	ND		1.0		ug/Kg		01/29/15 14:56	01/30/15 09:36	1
delta-BHC	ND		1.0		ug/Kg		01/29/15 14:56	01/30/15 09:36	1
gamma-BHC (Lindane)	ND		1.0		ug/Kg		01/29/15 14:56	01/30/15 09:36	1
4,4'-DDD	ND		2.0		ug/Kg		01/29/15 14:56	01/30/15 09:36	1
4,4'-DDE	ND		2.0		ug/Kg		01/29/15 14:56	01/30/15 09:36	1
4,4'-DDT	ND		2.0		ug/Kg		01/29/15 14:56	01/30/15 09:36	1
Dieldrin	ND		2.0		ug/Kg		01/29/15 14:56	01/30/15 09:36	1
Endosulfan I	ND		1.0		ug/Kg		01/29/15 14:56	01/30/15 09:36	1
Endosulfan II	ND		2.0		ug/Kg		01/29/15 14:56	01/30/15 09:36	1
Endosulfan sulfate	ND		2.0		ug/Kg		01/29/15 14:56	01/30/15 09:36	1
Endrin	ND		2.0		ug/Kg		01/29/15 14:56	01/30/15 09:36	1
Endrin aldehyde	ND		2.0		ug/Kg		01/29/15 14:56	01/30/15 09:36	1
Heptachlor	ND		2.0		ug/Kg		01/29/15 14:56	01/30/15 09:36	1
Heptachlor epoxide	ND		1.0		ug/Kg		01/29/15 14:56	01/30/15 09:36	1
Methoxychlor	ND		10		ug/Kg		01/29/15 14:56	01/30/15 09:36	1
Endrin ketone	ND		2.0		ug/Kg		01/29/15 14:56	01/30/15 09:36	1
Toxaphene	ND		100		ug/Kg		01/29/15 14:56	01/30/15 09:36	1
alpha-Chlordane	ND		1.0		ug/Kg		01/29/15 14:56	01/30/15 09:36	1
gamma-Chlordane	ND		1.0		ug/Kg		01/29/15 14:56	01/30/15 09:36	1
Surrogate	MB %Recovery	MB Qualifier	Limits				Prepared	Analyzed	Dil Fac
Tetrachloro-m-xylene	79		35 - 129				01/29/15 14:56	01/30/15 09:36	1
DCB Decachlorobiphenyl	82		60 - 128				01/29/15 14:56	01/30/15 09:36	1

Lab Sample ID: LCS 580-181345/2-A

Matrix: Solid

Analysis Batch: 181382

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 181345

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Aldrin	20.0	14.9		ug/Kg		75	59 - 127
alpha-BHC	20.0	13.7		ug/Kg		68	48 - 132
beta-BHC	20.0	15.6		ug/Kg		78	45 - 122
delta-BHC	20.0	11.2		ug/Kg		56	27 - 124
gamma-BHC (Lindane)	20.0	14.0		ug/Kg		70	47 - 127
4,4'-DDD	20.0	14.2		ug/Kg		71	48 - 136
4,4'-DDE	20.0	15.0		ug/Kg		75	50 - 138
4,4'-DDT	20.0	14.4		ug/Kg		72	53 - 132
Dieldrin	20.0	15.9		ug/Kg		79	53 - 145
Endosulfan I	20.0	16.8		ug/Kg		84	57 - 140
Endosulfan II	20.0	16.2		ug/Kg		81	58 - 144
Endosulfan sulfate	20.0	16.1		ug/Kg		80	55 - 125
Endrin	20.0	15.7		ug/Kg		79	51 - 143
Endrin aldehyde	20.0	14.1		ug/Kg		71	45 - 130
Heptachlor	20.0	14.9		ug/Kg		75	43 - 141
Heptachlor epoxide	20.0	14.7		ug/Kg		74	47 - 143
Methoxychlor	20.0	17.2		ug/Kg		86	56 - 137

TestAmerica Seattle

# QC Sample Results

Client: RGA Environmental, Inc.  
Project/Site: Fill Soil Test R3157050

TestAmerica Job ID: 580-47198-1

## Method: 8081B - Organochlorine Pesticides (GC) (Continued)

Lab Sample ID: LCS 580-181345/2-A

Matrix: Solid

Analysis Batch: 181382

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 181345

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Endrin ketone	20.0	15.6		ug/Kg		78	53 - 139
alpha-Chlordane	20.0	16.5		ug/Kg		82	52 - 137
gamma-Chlordane	20.0	15.4		ug/Kg		77	52 - 137

Surrogate	LCS %Recovery	LCS Qualifier	Limits
Tetrachloro-m-xylene	73		35 - 129
DCB Decachlorobiphenyl	80		60 - 128

Lab Sample ID: LCSD 580-181345/3-A

Matrix: Solid

Analysis Batch: 181382

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 181345

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Aldrin	20.0	15.4		ug/Kg		77	59 - 127	3	19
alpha-BHC	20.0	14.3		ug/Kg		71	48 - 132	5	17
beta-BHC	20.0	16.2		ug/Kg		81	45 - 122	3	18
delta-BHC	20.0	11.7		ug/Kg		58	27 - 124	4	19
gamma-BHC (Lindane)	20.0	14.6		ug/Kg		73	47 - 127	4	17
4,4'-DDD	20.0	14.7		ug/Kg		73	48 - 136	3	18
4,4'-DDE	20.0	15.6		ug/Kg		78	50 - 138	3	17
4,4'-DDT	20.0	14.7		ug/Kg		74	53 - 132	2	20
Dieldrin	20.0	16.3		ug/Kg		82	53 - 145	3	18
Endosulfan I	20.0	17.1		ug/Kg		86	57 - 140	2	19
Endosulfan II	20.0	16.7		ug/Kg		83	58 - 144	3	19
Endosulfan sulfate	20.0	16.5		ug/Kg		83	55 - 125	3	18
Endrin	20.0	16.1		ug/Kg		81	51 - 143	2	18
Endrin aldehyde	20.0	14.4		ug/Kg		72	45 - 130	2	21
Heptachlor	20.0	15.5		ug/Kg		77	43 - 141	4	18
Heptachlor epoxide	20.0	15.1		ug/Kg		76	47 - 143	3	17
Methoxychlor	20.0	17.7		ug/Kg		88	56 - 137	3	17
Endrin ketone	20.0	16.2		ug/Kg		81	53 - 139	3	17
alpha-Chlordane	20.0	16.9		ug/Kg		84	52 - 137	2	17
gamma-Chlordane	20.0	15.8		ug/Kg		79	52 - 137	3	17

Surrogate	LCSD %Recovery	LCSD Qualifier	Limits
Tetrachloro-m-xylene	78		35 - 129
DCB Decachlorobiphenyl	82		60 - 128

## Method: 8082A - Polychlorinated Biphenyls (PCBs) by Gas Chromatography

Lab Sample ID: MB 580-181345/1-A

Matrix: Solid

Analysis Batch: 181384

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 181345

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
PCB-1016	ND		0.010		mg/Kg		01/29/15 14:56	01/30/15 10:27	1
PCB-1221	ND		0.011		mg/Kg		01/29/15 14:56	01/30/15 10:27	1

TestAmerica Seattle



# QC Sample Results

Client: RGA Environmental, Inc.  
Project/Site: Fill Soil Test R3157050

TestAmerica Job ID: 580-47198-1

## Method: 8082A - Polychlorinated Biphenyls (PCBs) by Gas Chromatography (Continued)

Lab Sample ID: MB 580-181345/1-A

Matrix: Solid

Analysis Batch: 181384

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 181345

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
PCB-1232	ND		0.011		mg/Kg		01/29/15 14:56	01/30/15 10:27	1
PCB-1242	ND		0.010		mg/Kg		01/29/15 14:56	01/30/15 10:27	1
PCB-1248	ND		0.010		mg/Kg		01/29/15 14:56	01/30/15 10:27	1
PCB-1254	ND		0.010		mg/Kg		01/29/15 14:56	01/30/15 10:27	1
PCB-1260	ND		0.010		mg/Kg		01/29/15 14:56	01/30/15 10:27	1
Polychlorinated biphenyls, Total	ND		0.091		mg/Kg		01/29/15 14:56	01/30/15 10:27	1

Surrogate	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
DCB Decachlorobiphenyl	80		50 - 140	01/29/15 14:56	01/30/15 10:27	1
Tetrachloro-m-xylene	73		45 - 135	01/29/15 14:56	01/30/15 10:27	1

Lab Sample ID: LCS 580-181345/16-A

Matrix: Solid

Analysis Batch: 181384

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 181345

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
PCB-1016	0.100	0.0838		mg/Kg		84	40 - 140
PCB-1260	0.100	0.0826		mg/Kg		83	60 - 130

Surrogate	LCS %Recovery	LCS Qualifier	Limits
DCB Decachlorobiphenyl	79		50 - 140
Tetrachloro-m-xylene	70		45 - 135

Lab Sample ID: LCSD 580-181345/17-A

Matrix: Solid

Analysis Batch: 181384

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 181345

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
PCB-1016	0.100	0.0799		mg/Kg		80	40 - 140	5	20
PCB-1260	0.100	0.0804		mg/Kg		80	60 - 130	3	20

Surrogate	LCSD %Recovery	LCSD Qualifier	Limits
DCB Decachlorobiphenyl	77		50 - 140
Tetrachloro-m-xylene	67		45 - 135

## Method: 6010C - Metals (ICP)

Lab Sample ID: MB 580-181159/17-A

Matrix: Solid

Analysis Batch: 181181

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 181159

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		3.0		mg/Kg		01/27/15 15:51	01/28/15 05:58	1
Antimony	ND		3.0		mg/Kg		01/27/15 15:51	01/28/15 05:58	1
Beryllium	ND		0.50		mg/Kg		01/27/15 15:51	01/28/15 05:58	1
Cadmium	ND		1.0		mg/Kg		01/27/15 15:51	01/28/15 05:58	1
Chromium	ND		1.3		mg/Kg		01/27/15 15:51	01/28/15 05:58	1

TestAmerica Seattle

# QC Sample Results

Client: RGA Environmental, Inc.  
Project/Site: Fill Soil Test R3157050

TestAmerica Job ID: 580-47198-1

## Method: 6010C - Metals (ICP) (Continued)

Lab Sample ID: MB 580-181159/17-A

Matrix: Solid

Analysis Batch: 181181

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 181159

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Copper	ND		1.5		mg/Kg		01/27/15 15:51	01/28/15 05:58	1
Lead	ND	^	1.5		mg/Kg		01/27/15 15:51	01/28/15 05:58	1
Nickel	ND		1.0		mg/Kg		01/27/15 15:51	01/28/15 05:58	1
Selenium	ND		5.0		mg/Kg		01/27/15 15:51	01/28/15 05:58	1
Silver	ND		2.5		mg/Kg		01/27/15 15:51	01/28/15 05:58	1
Thallium	ND		5.0		mg/Kg		01/27/15 15:51	01/28/15 05:58	1
Zinc	ND		2.0		mg/Kg		01/27/15 15:51	01/28/15 05:58	1

Lab Sample ID: LCS 580-181159/18-A

Matrix: Solid

Analysis Batch: 181181

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 181159

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	200	188		mg/Kg		94	80 - 120
Antimony	150	137		mg/Kg		91	80 - 120
Beryllium	5.00	4.80		mg/Kg		96	80 - 120
Cadmium	5.00	4.69		mg/Kg		94	80 - 120
Chromium	20.0	17.6		mg/Kg		88	80 - 120
Copper	25.0	22.5		mg/Kg		90	80 - 120
Lead	50.0	48.5	^	mg/Kg		97	80 - 120
Nickel	50.0	49.0		mg/Kg		98	80 - 120
Selenium	200	184		mg/Kg		92	80 - 120
Silver	30.0	28.5		mg/Kg		95	80 - 120
Thallium	200	199		mg/Kg		99	80 - 120
Zinc	200	190		mg/Kg		95	80 - 120

Lab Sample ID: LCSD 580-181159/19-A

Matrix: Solid

Analysis Batch: 181181

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 181159

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Arsenic	200	180		mg/Kg		90	80 - 120	4	20
Antimony	150	132		mg/Kg		88	80 - 120	4	20
Beryllium	5.00	4.57		mg/Kg		91	80 - 120	5	20
Cadmium	5.00	4.48		mg/Kg		90	80 - 120	5	20
Chromium	20.0	16.8		mg/Kg		84	80 - 120	5	20
Copper	25.0	21.4		mg/Kg		86	80 - 120	5	20
Lead	50.0	46.5	^	mg/Kg		93	80 - 120	4	20
Nickel	50.0	46.6		mg/Kg		93	80 - 120	5	20
Selenium	200	176		mg/Kg		88	80 - 120	4	20
Silver	30.0	27.7		mg/Kg		92	80 - 120	3	20
Thallium	200	191		mg/Kg		96	80 - 120	4	20
Zinc	200	183		mg/Kg		91	80 - 120	4	20

TestAmerica Seattle

# QC Sample Results

Client: RGA Environmental, Inc.  
Project/Site: Fill Soil Test R3157050

TestAmerica Job ID: 580-47198-1

## Method: 6010C - Metals (ICP) (Continued)

Lab Sample ID: LCSSRM 580-181159/20-A

Matrix: Solid

Analysis Batch: 181181

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 181159

Analyte	Spike Added	LCSSRM Result	LCSSRM Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	139	130		mg/Kg		93.9	70.4 - 140.3
Antimony	88.8	153		mg/Kg		171.9	22.0 - 259.0
Beryllium	96.1	89.5		mg/Kg		93.2	74.5 - 125.9
Cadmium	96.0	92.2		mg/Kg		96.0	73.2 - 127.1
Chromium	136	133		mg/Kg		98.1	69.9 - 129.4
Copper	168	155		mg/Kg		92.5	75.6 - 125.0
Lead	133	128	^	mg/Kg		96.1	72.9 - 127.8
Nickel	123	125		mg/Kg		101.4	73.1 - 128.5
Selenium	177	166		mg/Kg		93.6	67.8 - 131.6
Silver	40.2	36.6		mg/Kg		91.1	66.2 - 134.1
Thallium	138	144		mg/Kg		104.2	68.1 - 131.9
Zinc	189	182		mg/Kg		96.5	69.8 - 130.7

## Method: 7471A - Mercury (CVAA)

Lab Sample ID: MB 580-181045/23-A

Matrix: Solid

Analysis Batch: 181152

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 181045

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.017		mg/Kg		01/27/15 10:00	01/27/15 11:19	1

Lab Sample ID: LCS 580-181045/24-A

Matrix: Solid

Analysis Batch: 181152

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 181045

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	0.167	0.155		mg/Kg		93	80 - 120

Lab Sample ID: LCSD 580-181045/25-A

Matrix: Solid

Analysis Batch: 181152

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 181045

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Mercury	0.167	0.145		mg/Kg		87	80 - 120	6	20

TestAmerica Seattle

# QC Sample Results

Client: RGA Environmental, Inc.  
Project/Site: Fill Soil Test R3157050

TestAmerica Job ID: 580-47198-1

## Method: 9060 - Organic Carbon, Total (TOC)

Lab Sample ID: MB 580-181316/3  
Matrix: Solid  
Analysis Batch: 181316

Client Sample ID: Method Blank  
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Organic Carbon	ND		2000		mg/Kg			01/29/15 08:57	1

Lab Sample ID: LCS 580-181316/4  
Matrix: Solid  
Analysis Batch: 181316

Client Sample ID: Lab Control Sample  
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Total Organic Carbon	2850	3400		mg/Kg		119	27.8 - 170

Lab Sample ID: LCSD 580-181316/5  
Matrix: Solid  
Analysis Batch: 181316

Client Sample ID: Lab Control Sample Dup  
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Total Organic Carbon	2850	3010		mg/Kg		106	27.8 - 170	12	35



# Lab Chronicle

Client: RGA Environmental, Inc.  
Project/Site: Fill Soil Test R3157050

TestAmerica Job ID: 580-47198-1

**Client Sample ID: 7050-01**

**Date Collected: 01/26/15 14:50**

**Date Received: 01/26/15 15:15**

**Lab Sample ID: 580-47198-1**

**Matrix: Solid**

**Percent Solids: 96.6**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3550B	DL		181341	01/29/15 14:23	ERZ	TAL SEA
Total/NA	Analysis	8270D	DL	10	181376	01/30/15 11:48	ERB	TAL SEA
Total/NA	Prep	3550B			181341	01/29/15 14:23	ERZ	TAL SEA
Total/NA	Analysis	8270D		1	181376	01/30/15 12:50	ERB	TAL SEA
Total/NA	Prep	3550B			181345	01/29/15 14:56	ERZ	TAL SEA
Total/NA	Analysis	8081B		1	181382	01/30/15 11:16	EKK	TAL SEA
Total/NA	Prep	3550B			181345	01/29/15 14:56	ERZ	TAL SEA
Total/NA	Analysis	8082A		1	181384	01/30/15 11:34	EKK	TAL SEA
Total/NA	Prep	3050B			181159	01/27/15 15:51	PAB	TAL SEA
Total/NA	Analysis	6010C		1	181181	01/28/15 07:15	HJM	TAL SEA
Total/NA	Prep	7471A			181045	01/27/15 10:00	PAB	TAL SEA
Total/NA	Analysis	7471A		1	181152	01/27/15 12:29	SPP	TAL SEA
Total/NA	Analysis	9060		1	181316	01/29/15 09:45	RSB	TAL SEA
Total/NA	Analysis	D 2216		1	181262	01/28/15 16:50	ERZ	TAL SEA

## Laboratory References:

TAL SEA = TestAmerica Seattle, 5755 8th Street East, Tacoma, WA 98424, TEL (253)922-2310

## Certification Summary

Client: RGA Environmental, Inc.  
Project/Site: Fill Soil Test R3157050

TestAmerica Job ID: 580-47198-1

### Laboratory: TestAmerica Seattle

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
Alaska (UST)	State Program	10	UST-022	03-04-15
California	State Program	9	2901	01-31-15
L-A-B	DoD ELAP		L2236	01-19-16
L-A-B	ISO/IEC 17025		L2236	01-19-16
Montana (UST)	State Program	8	N/A	04-30-20
Oregon	NELAP	10	WA100007	11-06-15
US Fish & Wildlife	Federal		LE192332-0	02-28-16
USDA	Federal		P330-11-00222	04-08-17
Washington	State Program	10	C553	02-17-15

## Sample Summary

Client: RGA Environmental, Inc.  
Project/Site: Fill Soil Test R3157050

TestAmerica Job ID: 580-47198-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
580-47198-1	7050-01	Solid	01/26/15 14:50	01/26/15 15:15

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☒ Rush      3day JAT

☐ Short Hold

### **Chain of Custody Record**

[illegible]

Cooler <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Cooler Temp: _____		Possible Hazard Identification <input checked="" type="checkbox"/> Non-Hazard <input type="checkbox"/> Flammable <input type="checkbox"/> Skin Irritant <input type="checkbox"/> Poison B <input type="checkbox"/> Unknown		Sample Disposal <input type="checkbox"/> Return To Client <input checked="" type="checkbox"/> Disposal By Lab		(A fee may be assessed if samples are retained longer than 1 month)	
				<input type="checkbox"/> Archive For _____ Months			
Turn Around Time Required (business days) <input type="checkbox"/> 24 Hours <input type="checkbox"/> 48 Hours <input type="checkbox"/> 5 Days <input type="checkbox"/> 10 Days <input type="checkbox"/> 15 Days <input checked="" type="checkbox"/> Other <u>3 days</u>				QC Requirements (Specify)			
1. Relinquished By Sign/Print <u>gn Stahl</u> <u>Emily Kahler</u>		Date <u>1/26/15</u> Time <u>3:15</u>		1. Received By Sign/Print <u>D Vance</u>		Date <u>01/26/15</u> Time <u>15:15</u>	
2. Relinquished By Sign/Print		Date Time		2. Received By Sign/Print		Date Time	
3. Relinquished By Sign/Print		Date Time		3. Received By Sign/Print		Date Time	
Comments							

## Login Sample Receipt Checklist

Client: RGA Environmental, Inc.

Job Number: 580-47198-1

**Login Number: 47198**

**List Source: TestAmerica Seattle**

**List Number: 1**

**Creator: Blankinship, Tom X**

Question	Answer	Comment
Radioactivity wasn't checked or is $\leq$ background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	Received same day of collection; chilling process has begun.
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	False	no labels, ID only written on cap.
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is $<6\text{mm}$ (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	



**Murray Morgan Bridge Remedial Action**

**Remedial Action  
Construction Report**

**Appendix E  
Waste Characterization and Disposal  
Documentation**

February 18, 2015

Vernon Uy  
American Construction Co.  
1501 Taylor Way  
Tacoma, WA 98421

RE: Dredging Soils and Water Testing – Revision 1  
Composite from Barge Stockpile and Wastewater Sample  
American Construction  
Port of Tacoma

RGA Job# R3157057

On February 10, 2015, Emily Kahler, Industrial Hygienist for RGA Environmental, a Terracon Company (RGA) collected samples of waste waters and dredged soil from barge stockpiles. The sampling event was conducted at American Construction's facility in Tacoma, Washington. The purpose of the testing was to profile waste water and soil with respect to City of Tacoma Sanitary Sewer Discharge Limits. Access to the American Construction Site was facilitated by Mr. Vernon Uy of American Construction who assisted with collection of a composite water and soil sample from the barge storage tanks.

## BACKGROUND AND METHODOLOGIES

American Construction is performing a dredging project that will require disposal of the soil and waste water. One, five gallon container of waste water and one, five gallon container of dredge spoils was composited from dredge spoils piles and barge storage tanks on barges located at American Construction's Tacoma Facility by Mr. Uy. The composited material was provided to RGA for purposes of collecting samples for analysis. Water samples for contaminants of concern (Suspended solids, heavy metals, Residual Chlorine, TPH, pH, Cyanide and BTEX) were collected in sampling bottles with preservatives appropriate to the contaminant. Soil samples for contaminants of concern (RCRA 8) were collected in sample jars. See Table 1 for testing results for water samples correlated to the respective City of Tacoma Discharge Criteria. See Table 2 for soil testing results. The full laboratory reports are attached.

## FINDINGS

Tables 1 and 2 present results for analytical parameters from samples collected on February 10, 2015. All samples except for residual chlorine were submitted to Friedman and Bruya of Seattle, WA for analysis. The residual chlorine sample was submitted to by Aquatic Research of Seattle, WA for analysis.

Table 1—Water Testing Results – February 10, 2015 - Sample Set 7057-01

Analytes	Method <sup>1</sup>	Results: 7058-01	Results: 7058-CH-01	City of Tacoma (COT) Discharge Limit
pH	150.2	7.55		5.5-11
Chlorine Total Residual	4500 Cl-G		<0.05 mg/L	2 mg/L

<sup>1</sup> Numbered methods are EPA analytical methods

Analytes	Method <sup>1</sup>	Results: 7058-01	Results: 7058-CH-01	City of Tacoma (COT) Discharge Limit
Total Suspended Solids (TSS)	SM 2540 D	380 mg/L		225 mg/L
Arsenic	200.8	0.0537 mg/L		0.1 mg/L
Cadmium	200.8	<0.010 mg/L		0.25 mg/L
Chromium (total)	200.8	0.0125 mg/L		1.0 mg/L
Chromium (hexavalent)	7196	<0.050 mg/L		0.25 mg/L
Copper	200.8	0.127 mg/L		1.0 mg/L
Mercury	200.8	<0.010 mg/L		0.05 mg/L
Nickel	200.8	0.0142 mg/L		1.0 mg/L
Selenium	200.8	0.132 mg/L		0.1 mg/L
Zinc	200.8	0.210 mg/L		2.0 mg/L
Silver	200.8	<0.010 mg/L		0.2 mg/L
Molybdenum	200.8	0.0412 mg/L		1.0 mg/L
Lead	200.8	0.0786 mg/L		0.4 mg/L
TPH Components (HEM Oil & Grease; SGT HEM; HEM Polar Oil & Grease)	1664A Local Method	<3 mg/L		50 mg/L
Cyanide	SM 4500-CN, C E	<0.05 mg/L		0.64 mg/L
BTEX	8260 D	Benzene <0.00035 mg/L Toluene <0.001 mg/L Ethylbenzene <0.001 mg/L m,p-Xylene <0.002 mg/L o-Xylene <0.001 mg/L		Total BTEX 10 mg/L; Benzene <0.5 mg/L

Table 2—Soil Testing Results (7057-Soil-01) - EPA 6010/7470 (Results in mg/kg)

Analyte	Result
Arsenic	22.9
Barium	16.3
Cadmium	1.03
Chromium	18.2
Lead	200
Mercury	<1
Selenium	<1
Silver	1.17

All of the water testing parameters were below the COT discharge Limit with the exception of total suspended solids (TSS).

#### LIMITS OF SURVEY

This report does not represent all conditions at the subject site as it only reflects the information gathered from specific locations. Observation or sampling of other work areas was not within the scope of RGA's work and was not performed.

This report was prepared pursuant to the contract RGA has with the client. Unauthorized reliance on or use of this report, including any of its information or conclusions, will be at third party's risk. For the same reasons, no warranties or representations, expressed or implied in this report, are made to any such third party.

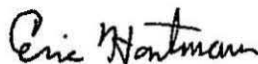
Contact us at 206-281-8858 with any questions.

Report Prepared by,



Emily Kahler  
Industrial Hygienist  
RGA Environmental, Inc.

Report Reviewed by,



Eric Hartman, CIH  
Senior Project Manager  
RGA Environmental, Inc.

Attachments:

*Lab Report*



February 24, 2015

Vernon Uy  
American Construction  
1501 Taylor Way  
Tacoma, WA 98421

RE: Analytical Results for Total Lead  
RGA Batch # 15-0278  
Matrix – TCLP

Dear Vernon,

Enclosed are the results of the samples recently submitted to our laboratory for analysis. These samples were analyzed for the metals listed on the enclosed report following the specified EPA Methods listed.

RGA Environmental, Inc. appreciates the opportunity to be of service to you on this project, and hopes that you will consider working with our company again in the future. Please feel free to contact me if I may be of additional assistance.

Sincerely,

Adam Kinch  
Laboratory Director

*enclosure: Lab Results*





February 24, 2015

## RGA Batch # 15-0278

Client: Vernon Uy  
Company: American Construction  
1501 Taylor Way  
Tacoma, WA 98421

Project: Murray Morgan Bridge  
Matrix: TCLP- Lead  
Date Sampled: 2/20/2015  
Date Received: 2/20/2015  
Date Analyzed: 2/24/2015

Project #: N/A  
P.O. #: 18605  
Sampled By: Client  
Method: EPA SW-846 Method 7420  
Analyst: *Rebecca Ferrell*

## LEAD SAMPLE RESULTS

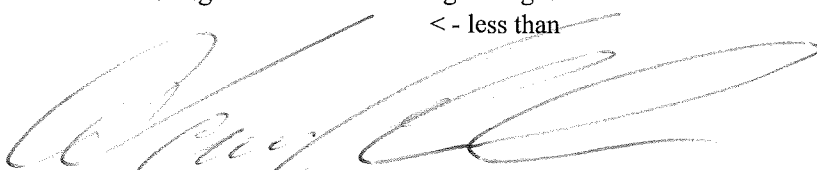
RGA Lab ID	Client ID	RL (mg/L)	Concentration (mg/L)
15002202	TCLP Testing	0.26	< 0.26

QA/QC Results  
Batch QC BS  
Method Blank

96% Recovery  
<0.5 ug/ml

RL - reporting limit  
mg - milligrams  
kg - kilograms  
< - less than

Reviewed by:

  
Adam Kinch, Laboratory Director

**RGA Environmental, Inc.**

3317 3rd Avenue S, Suite D

Seattle, WA 98134

www.rgaenv.com

Ph: (206) 281-8858 Fax: (206) 281-8922

# Sample Log

## Chain of Custody

Client Company: American Construction

Client Address: 1501 Taylor Way

Tacoma WA 98421-  
City State Zip

Phone #: (253)254-0118

2nd or Cell #: (425)870-3217

Fax #: (253)254-0155

e-mail Address: vernonu@americanconstco.com

Attention to: Vernon Uy

Project Location: Murray Morgan Bridge

Condition: ☒ Good ☐ Damaged ☐ Severe Damage

RGA Batch #: 15-0278

Client Job #:

Client P.O. #: 18605

Number of Samples: 1

**TYPE OF ANALYSIS**

ASBESTOS:

METALS: Pb

PCM (air)

Paint

Soil

PLM (bulk)

Wipe

Air

Pt. Count (bulk)

X TCLP

Water

Other (Specify Method):

Turn Around Time (other): 48 hour

2 hour / 4 hour

Same Day

One Day

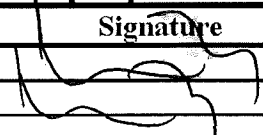
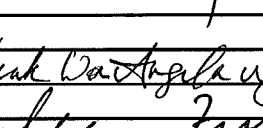
~~Two Day~~

3 days

5 Days

Price per Sample: \$ 110.00

#	Client Sample ID	RGA Laboratory ID	Comments	#	Client Sample ID	RGA Laboratory ID	Comments
1	TCLP testing	15002202		11			
2				12			
3				13			
4				14			
5				15			
6				16			
7				17			
8				18			
9				19			
10				20			

	Signature	Date	Time
Sampled by:		2/20/15	3:12 PM
Relinquished by:		2/20/15	3:12 PM
Received by:			
Relinquished by:			
Received for Laboratory by:	Chen Da Angela Uy	2/20/2015	1515
Analyzed by:	Robert [Signature]	2/24/15	1115
Preliminary Results Reported to Client by:			
Final Report to Client by:		2/25/15	

**Special Instructions:**

Due 2/24/2015.



## INVOICE # 15-0278

February 24, 2015

Client: Vernon Uy  
Company: American Construction  
1501 Taylor Way  
Tacoma, WA 98421

Attention: Accounts Payable  
Project: Murray Morgan Bridge  
Project #: N/A  
P.O. # 18605

### LABORATORY ANALYSIS SERVICES

Service	Date	Rate	# of Samples	Extended Price
TCLP - Pb	February 24, 2015	\$110.00	1	\$110.00

Please Pay This Amount:

\$110.00

Please Remit to: R3137003  
RGA Environmental, Inc.  
P.O. Box 843358  
Kansas City, MO 64184-3358  
(206) 281-8858 or (888) 281-8858  
Federal Tax ID # (b) (6), (b) (7)(C)

Terms are Net upon Invoicing



# Republic Services, Inc.

18500 N. Allied Way, Phoenix, AZ 85054

## SPECIAL WASTE DEPARTMENT DECISION

Waste Profile #  
4178153075

Expiration Date  
2/25/2016

### I. Decision Request:

☒ Initial

☐ Recertification

☐ Change

Disposal Facility: 4178 - Roosevelt Regional MSW L/F

Generator Name: American Construction Company Inc

Generator Site Address: Thea Foss Waterway by West Pier of Murray Morgan B

City: Tacoma

County:

State: WA

Zip:

Name of Waste: Dredged Soils

Estimated Annual Volume: 130 Cubic Yards

### II. Special Waste Department Decision:

☒ Approved

☐ Rejected

Management Method(s):

☒ Landfill

☐ Solidification

☐ Bioremediation

☐ Transfer Facility

Problematic Special Waste according to Republic?

☐ Yes

☒ No

If yes, which one?

Approved by Special Waste Review Committee?

☐ Yes

☐ No

☒ Not Applicable

### Precautions, Conditions or Limitations on Approval

Special Waste Analyst Signature: \_\_\_\_\_

Date: 2/25/2015

Name (Printed): Suzanne Glass

### III. Facility Decision:

☐ Approved

☐ Rejected

### Precautions, Conditions or Limitations on Approval

By signing below, the General Manager or Designee agrees that a fully executed Special Waste Service Agreement is on file for this profile and that the special waste file is complete.

General Manager or Designee: \_\_\_\_\_

Date: 2/25/2015

Name (Printed): \_\_\_\_\_



## SPECIAL WASTE SERVICE AGREEMENT NON-HAZARDOUS WASTES

Special Waste Profile Number: 4178153075

### Generator Billing Information

Name: American Construction  
Address: 1501 Taylor Way  
City: Tacoma  
State: WA Zip: 98421  
Phone: 253.254.0118 Fax:   
Contact: Vernon Uy

### Republic Waste Location (Company)

Roosevelt Regional MSW Landfill  
500 Roosevelt Grade Road  
Roosevelt, WA 98356

Project: Thea Foss Waterway, Tacoma County and State of Origin: Pierce, WA

Additional Information:

1. **Special Waste Service.** Subject to the terms and conditions contained herein, the Company and the Generator agree to be legally bound hereby and the Company agrees to accept at its Facility, Acceptable Waste (hereinafter referred to as "Special Waste" or "Waste") delivered by Generator, and which is acceptable to the Company as herein provided.
2. **Acceptable Waste.** Only those Special Wastes described in Paragraph 3 herein and in any Special Waste Profile(s) which number is identical to the contract number referenced above, and which Profile(s) are hereby incorporated by reference herein, and which Waste is subsequently approved by the Company and is otherwise in accordance with all laws, regulations and permits, shall be acceptable for disposal at the Facility ("Acceptable Waste").

### 3. (A) Rates for Disposal:

<u>Waste</u>	<u>Disposal Method</u>	<u>Disposal Rate:</u>	<u>Fees / Taxes / Misc.</u>	<u>Transportation</u>
		\$1125.00 per load based on a min. of 25 tons. \$45.00 per ton over 25	See additional info below	\$135.00 per hour
<u>76-Dredge Sediment</u>	<u>Landfill</u>			

Additional Information:

Additional \$50.00 per load for RDC provided liner.

Generator shall also be liable for all taxes, fees, or other charges imposed by federal, state, local or provincial laws and regulations.

Cannot Exceed Daily Volume of  Without Prior Approval of Company.

- (B) **Incorporation by Reference.** In addition to Special Waste Profile(s), the following documents are incorporated by reference into this Agreement as if fully set forth herein.

1) Bill of Lading-LW-15021

2)

4. **Term of Agreement.** This Agreement is effective for 5 months, commencing 2/25/2015 and shall automatically be renewed for a similar term thereafter unless either party shall give written notice (via certified mail) of termination to the other party at least thirty (30) days prior written notice.

THE COMPANY AND THE GENERATOR, IN CONSIDERATION OF THE MUTUAL OBLIGATIONS CONTAINED HEREIN, AGREE THAT THIS IS A LEGALLY BINDING AGREEMENT WHICH IS SUBJECT TO THE TERMS AND CONDITIONS SET FORTH ON THIS PAGE AND ON THE REVERSE SIDE OF THIS DOCUMENT. IN ADDITION, THE GENERATOR IS CERTIFYING THE ATTACHED TERMS AND CONDITIONS HAVE BEEN REVIEWED AND INITIALLED AT THE BOTTOM OF THE PAGE.

### GENERATOR

SIGNATURE (AUTHORIZED REPRESENTATIVE)

VERNON UY, PROJECT ENGINEER

NAME AND TITLE (PLEASE PRINT)

2/25/2015  
DATE

### REPUBLIC SERVICES, INC./COMPANY

SIGNATURE (AUTHORIZED REPRESENTATIVE)

NAME AND TITLE (PLEASE PRINT)

DATE



# **Terms and Conditions of Special Waste Service Agreement**

5. **The Agreement** This agreement of the parties ("Agreement") for the disposal of Special Waste shall consist of this Agreement, riders to the Agreement (if any) and any Application, permit and approval that may be applicable to such Waste.
6. **Waste Accepted at Facility** Generator represents, warrants and covenants that the Waste delivered to Company at its Facility hereunder will be Acceptable Waste and will not contain any unacceptable quantity of hazardous materials or substances, radioactive materials or substances, or toxic waste or substances, as defined by applicable federal, state, local or provincial laws or regulations. Any Waste which does not meet these requirements shall hereinafter be referred to as "Unacceptable Waste". The Generator shall in all matters relating to the collection, transportation and disposal of the Waste hereunder, comply with all applicable federal, state and local laws, regulations, rules and orders regarding the same. The word "Facility" shall mean any landfill, transfer station or other location used to transfer, process or otherwise dispose of such Waste.
7. **Special Waste** Generator represents, warrants and covenants that the Waste delivered to Company hereunder (i) will not contain any Special Waste that is not specifically described on any Application which is attached hereto or which is subsequently approved by the Company, (ii) will meet the material description as set forth in any Application and otherwise in all significant respects and (iii) will not contain Unacceptable Waste. The parties may incorporate additional Special Waste as part of this Agreement if prior to delivery of such Waste to Company, Generator has provided an Application for such Waste and Company has approved disposal of such Waste within the limitations and conditions contained in Company's written notice of approval of Special Waste Disposal. Title to any and all Waste handled or disposed of by Company shall at all times remain with Generator and Broker (if a Broker is involved).
8. **Rights of Refusal/Rejection** The Generator shall inspect all Waste at the place(s) of collection and shall remove any and all Unacceptable Waste. Company has the right to refuse, or to reject after acceptance, any load(s) of Waste(s) delivered to its Facility including if the Company believes the Generator has breached (or is breaching) its representations, warranties, covenants or agreements hereunder, or any applicable federal, state or local laws, regulations, rules or orders, even if only a portion of such Waste load is unacceptable. The Company shall have the right to inspect all vehicles and containers of Waste haulers, including the Generator's vehicles, in order to determine whether the Waste is Acceptable Waste or Unacceptable Waste pursuant to this Agreement and all applicable federal, state and local laws, rules and regulations. The Company's exercise, or failure to exercise, its rights hereunder shall not operate to relieve the Generator of its responsibilities or liability under this Agreement. The Generator shall be responsible for, and bear all reasonable expenses and damages incurred by the Company, as a result of the Unacceptable Waste and in the reloading and removal of Unacceptable Waste disposed in the Facility. The Company, may also, in its sole discretion, require the Generator to promptly remove the Unacceptable Waste.
9. **Limited License to Enter** This Agreement provides Generator with a license to enter the Facility for the limited purpose of, and only to the extent necessary for, off-loading Acceptable Waste at the Facility in the manner directed by Company. Except in an emergency, Generator's personnel shall not leave the immediate vicinity of their vehicle. After off-loading the Waste, Generator's personnel shall promptly leave the Facility. Under no circumstances shall Generator or its personnel engage in any scavenging of Waste or other materials at the Facility. The Company reserves the right to make and enforce reasonable rules and regulations concerning the operation of the Facility, the conduct of the drivers and others on the Facility premises, quantities and sources of Waste, and any other matters necessary or desirable for the safe, legal and efficient operation of the Facility including, but not limited to, speed limits on haul roads imposed by the Company, and the wearing of hard hats and other personal protection equipment by all individuals allowed on the Facility premises. Generator agrees to conform to such rules and regulations as they may be established and amended from time to time. Company may refuse to accept Waste from and shall deny an entrance license to, any of Generator's personnel whom Company believes is under the influence of alcohol or other chemical substances. Generator shall be solely responsible for its employees and subcontractors performing their obligations in a safe manner when at the facility of Company.
10. **Charges and Payment** Payment shall be made by Generator within thirty (30) days after receipt of invoice from Company. In the event that any amount is overdue, the Company may terminate this Agreement. Generator agrees to pay a finance charge equal to the maximum interest rate permitted by law. Generator shall be liable for all taxes, fees, or other charges imposed upon the disposal of the Waste by federal, state, local or provincial laws and regulations. Company, from time to time, may modify its rates upon thirty (30) days written notice to Generator.
11. **Termination** Generator's obligations, representations, warranties and covenants regarding the Waste delivered and all indemnities shall survive termination of this Agreement. Should Generator materially default in any of its obligations hereunder, then Company may immediately terminate this Agreement and Generator shall be liable for all costs and damages incurred by the Company.
12. **Driver's Knowledge and Authority** Generator represents, warrants and covenants that its drivers who deliver Waste to Company's Facility have been advised by Generator of the Company's prohibition on deliveries of hazardous materials or substances, radioactive materials or substances, or toxic waste or substances or any other Unacceptable Waste to the Facility of Company's restrictions on deliveries of Special Waste to the Facility, of the definitions of "Hazardous Waste and Hazardous Substances" as provided by applicable federal, state and local law, rules and regulations and "Special Waste" as provided herein, and of the terms of this license to enter Company's Facility.
13. **Indemnification** Generator shall indemnify, defend and hold harmless the Company and its subsidiaries, affiliates and parent corporations, as applicable and their respective officers, directors, lenders, employees, subcontractors and agents from and against any and all claims, suits, losses, liabilities, assessments, damages, fines, costs and expenses, including reasonable attorneys fees arising under federal, state or local laws, regulations or ordinances, or relating to the content of the Waste, or arising out of or in connection with any breach of this Agreement or arising out of the negligent collection, transportation and disposal of Waste by Generator or Generator's employees, agents, subcontractors or representatives thereof. Generator shall also be responsible for increased inspection, testing, study and analysis costs made necessary due to reasonable concerns of the Company as to the content of the Waste following discovery of potentially Unacceptable Waste. This indemnification and other obligations stated in this paragraph shall survive the termination of this Agreement.
14. **Insurance** Generator shall maintain in full force and effect throughout the term of this Agreement the following types of insurance in at least the amounts specified below:

Coverages	Minimum Amounts of Insurance
Worker's Compensation	Statutory
General Liability	\$500,000 combined single limit
Automobile Liability	\$500,000 combined single limit

All insurance will be by insurers authorized to do business in the state in which the Facility is located. Prior to Generator being allowed on Facility premises, Generator shall provide the Company with certificates of insurance or other satisfactory evidence that such insurance has been procured and is in force. Said policies shall not thereafter be canceled, be permitted to expire or lapse, or be changed without thirty (30) days advance written notice to the Company. Generator warrants that it will secure the above minimum amounts of insurance from any transportation of the Waste to the Facility.

15. **Failure to Perform** Neither party hereto shall be liable for its failure to perform hereunder due to circumstances not its fault and beyond its reasonable control, including, but not limited to, strikes or other labor disputes, riots, protests, civil disturbances or sabotage, changes in law, fires, floods, compliance with government requests, explosions, accidents, weather, lack of required natural resources, or acts of God affecting either party hereto. In the event of any of the circumstances provided for in the preceding sentence, including, but not limited to, whether any federal, state or local court or governmental authority takes any action which would (i) close or restrict operations at the Facility, (ii) limit the quantity or prohibit the disposal of Waste at the Facility, or (iii) limit the ability of or prohibit Generator from delivering Waste to the Facility, the Company shall have the right, at its option, to reduce, suspend or terminate Generator's access to the Facility immediately, without prior notice and without any additional liabilities between the parties, other than Generator's payment obligation hereunder. Neither Party is required hereunder to settle any labor dispute against its own best judgment.
16. **Other Termination** The occurrence of any of the following events shall also constitute an event of default by the Generator and shall give the Company the right to immediately terminate this Agreement:
  - (A) A petition for reorganization or bankruptcy filed by or against the Generator.
  - (B) Failure by Generator to pay any amounts due to Company.
  - (C) Any breach by Generator of any of its obligations pursuant to the Agreement.

Generator shall be liable for and shall indemnify, defend and hold harmless Company from any losses, claims expenses or damages incurred by the Company as a result of termination hereunder.

17. **Assignment** Generator may not assign, transfer or otherwise vest in any other Company, entity or person, in whole or in part, any of its rights or obligations under the Agreement without the prior written consent of the Company, provided, however, that the Company may without any such prior written consent, assign its rights and/or obligations under the Agreement to a subsidiary or affiliate corporation.
18. **Right of Disposal** This Agreement does not grant any rights to dispose of Waste other than in accordance herewith. The Company reserves the right to immediately terminate access to the Facility by Generator and Generator's personnel in the event of breach or violation by Generator of any of the terms of this Agreement, the Company's operating rules or payment policies or any applicable laws or regulations.
19. **Continuing Compliance** The Generator has a continuing obligation to inform the Company of any new information, or information not previously provided to the Company by Generator which may affect the acceptability of the Waste by the Company. Further, the Generator shall comply with all Company requests for evidence of Generator's continuing compliance with the terms of the Agreement including but not limited to the following: (i) providing new, updated Waste profiles on the Waste(s) offered for disposal or, (ii) providing appropriate certification that the Waste being offered for disposal is accurately reflected by the appropriate Application or, (iii) re-sample the Waste at Generator's expense if reasonable cause exists as to its acceptability under the terms of this Agreement or, (iv) allow the Company to re-sample the Waste at Generator's expense if reasonable cause exists as to its acceptability under the terms of this Agreement or (v) all of the above.
20. **Miscellaneous**
  - (A) This Agreement shall be governed by the laws of the State in which the Facility is located.
  - (B) No waiver of a breach of any of the obligations contained in the Agreement shall be construed to be a waiver of any prior or succeeding breach of the same obligation or of any other obligation of this Agreement.
  - (C) No modification, release, discharge or waiver of any provision or obligation hereof shall be of any force, or effect, unless in writing signed by all parties to this Agreement.
  - (D) Generator shall treat as confidential and not disclose to others during or subsequent to the terms of this Agreement, except as is necessary to perform this Agreement, or to comply with any applicable law or regulation any information (including any technical information, experience or data) regarding the Company's plans, programs, plants, processes, products, costs, equipment or operations which may come within the knowledge of the Generator or its employees in the performance of this Agreement, without in each instance securing the prior written consent of the other Company.
  - (E) If any term, phrase, obligation or provision of this Agreement shall be held to be invalid, illegal or unenforceable in any respect, this Agreement shall remain in effect and be construed without regard to such term, phrase, obligation or provision.
  - (F) This Agreement constitutes the entire understanding between the parties, replacing and amending any prior agreements between the parties, and shall be binding upon all parties hereto, their successors, heirs, representatives and assigns. Any provision, term or condition in any acknowledgement, purchase order or other response by Generator which is in addition to or different from the provisions of this Agreement shall be deemed objected to by the Company and shall be of no effect.
  - (G) Generator represents, warrants and covenants that it is and, during the term of this Agreement will remain, in compliance with and will perform its obligations pursuant to all applicable laws and regulations and shall indemnify, defend and hold harmless the Company from any breach thereof.
  - (H) It is the understanding and agreement of the parties that the Company is an independent contractor, and is not an agent, nor an authorized representative of the Generator.

Generator shall be liable for and shall indemnify, defend and hold harmless Company from any losses, claims expenses or damages incurred by the Company as a result of termination hereunder.

21. **Notices** All notices herein provided for shall be considered as having been given upon being placed in the mail, certified postage prepaid addressed to the Company or Generator at the address herein set forth in this Agreement or to such other address as may be given to the other party in writing.
22. **Liquidated Damages** In the event that this Agreement is terminated by the Generator in a manner not in accordance with paragraph 4 hereof, or terminated due to a breach of this Agreement by the Generator, the Generator shall pay, as liquidated damages, and not as a penalty, the greater of an amount equal to six (6) months' service charges or the Generator's most recent monthly charge multiplied by six (6). The Generator shall be given credit for any advance payments made hereunder, however, in computing the amount owed as liquidated damages hereunder. The Generator acknowledges that this liquidated damages clause is reasonable and is applicable to recover damages related to its investment in equipment, development of landfills and hiring of employees undertaken by the Company to service its customers including the Generator. This liquidated damages clause in no way relieves the Generator from its obligations and liability for other cost or damages as set forth elsewhere in this Agreement.

GENERATOR: V. Uy

REPUBLIC SERVICES/COMPANY: \_\_\_\_\_

May 2009

Certification No. LW 15021  
Billing Acct. No. 12466  
Product Code 76

**BILL OF LADING**

**Contaminated Soil**

**REGIONAL DISPOSAL COMPANY**

54 S. Dawson Street

Seattle, WA 98134

Telephone: (206) 332-7700 / Fax: (206) 332-7600

This Bill of Lading augments the Master Service Agreement ("Agreement") entered into by American (Generator/Agent) and Regional Disposal Company ("RDC") on 2/25/15 (date). The terms herein are made a part of the Agreement. In the event of conflict between this Bill of Lading and the Agreement, the terms of the Agreement prevail.

RDC hereby authorizes the Wastes ("Waste") described in Certification No. LW 15021 signed by Generator/Agent on 2/25/15 (date), for disposal at Roosevelt Regional Landfill. Contractor shall present a copy of this Bill of Lading with each shipment delivered.

Location of Waste: Thra Foss Waterway, Tacoma

Method of Shipment: RDC HAUL

Additional Fees (e.g., laboratory fees, transportation fees, special handling fees, etc. If none, so state):

**PERFORMANCE DATE**

**FOR RDC TRANSPORTATION:** Generator shall make the Waste available for shipment no later than \_\_\_\_\_ (date). RDC shall transport the Waste no later than \_\_\_\_\_ (date), unless RDC notifies the Generator in writing that Waste transport shall be suspended or canceled due to RDC's exercise of its right to inspect or analyze the Waste (as provided in the Agreement).

**FOR GENERATOR TRANSPORTATION:** Agent shall begin delivery of the Waste at [check one]:

☒ Roosevelt Regional Landfill. ☐ Seattle Transfer Station located at Third and Lander.

Waste delivery shall begin no later than 2/25/15 (date), and shall complete delivery of the Waste no later than 12/31/15 (date), unless RDC notifies Generator/Agent in writing to suspend or cancel the waste delivery due to RDC's exercise of its right to inspect or analyze the Waste (As provided in the Agreement).

GENERATOR / AGENT

REGIONAL DISPOSAL COMPANY

Signature

Signature

VERNON WY, PROJECT ENGINEER

Printed Name and Title

Printed Name and Title

2/25/2015

Date

Date



Requested Disposal Facility: 4178 Roosevelt Regional MSW LF WA

Waste Profile #

4178 15 3075

Saveable fill-in form. Restricted printing until all required (yellow) fields are completed.

Sales Rep #: 253 - Leslie Whiteman

**I. Generator Information**

Generator Name: American Construction Company, Inc.

Generator Site Address: Thea Foss Waterway, by West Pier of Murray Morgan Bridge

City: Tacoma County: Pierce State: Washington Zip: 98402

State ID/Reg No: State Approval/Waste Code: (if applicable) NAICS #:

Generator Mailing Address (if different): ☐ Thea Foss Waterway, by West Pier of Murray Morgan Bridge

City: Tacoma County: State: Washington Zip: 98402

Generator Contact Name: American Construction Company, Inc. Email: vernonu@americanconstco.com

Phone Number: (253) 254-0118 Ext: Fax Number: (253) 254-0155

**II. Billing Information**

Bill To: American Construction Company, Inc.

Contact Name: Vernon Uy

Billing Address: 1501 Taylor Way

Email: vernonu@americanconstco.com

City: Tacoma State: WA Zip: 98421 Phone: (253) 254-0118

**III. Waste Stream Information**

Name of Waste: Dredged soils

Process Generating Waste:

Remedial dredging of 3,000 SF area of existing mudline underneath the Murray Morgan Bridge (11th Street Bridge) in the Thea Foss Waterway. Purpose of remedial dredging is to cleanup the metals that have fallen-off of the Murray Morgan Bridge (fallen into the Thea Foss waters) during the bridge's rehabilitation project back in 2011-2013.

Type of Waste: ☐ INDUSTRIAL PROCESS WASTE ☒ POLLUTION CONTROL WASTEPhysical State: ☒ SOLID ☐ SEMI-SOLID ☐ POWDER ☐ LIQUIDMethod of Shipment: ☒ BULK ☐ DRUM ☐ BAGGED ☐ OTHER:

Estimated Annual Volume: 130 Cubic Yards

Frequency: ☒ ONE TIME ☐ ONGOINGDisposal Consideration: ☒ LANDFILL ☐ SOLIDIFICATION ☐ BIOREMEDIATION**IV. Representative Sample Certification**☐ NO SAMPLE TAKEN

Is the representative sample collected to prepare this profile and laboratory analysis, collected in accordance with U.S. EPA 40 CFR 261.20(c) guidelines or equivalent rules?

☒ YES or ☐ NOType of Sample: ☒ COMPOSITE SAMPLE ☐ GRAB SAMPLE

Sample Date: 2/10/15

Sample ID Numbers: 502128-02 (or, 7057-Soil-01).

15-0278 (TCLP - Lead) dated 2/20/15. This represent the sample (7057-Soil-01) which has the lead content of 200ppm.





Waste Profile #

**V. Physical Characteristics of Waste**

Characteristic Components		% by Weight (range)			
1. Soils		95			
2. Water in the soils		5			
3.					
4.					
5.					
Color	Odor (describe)	Does Waste Contain Free Liquids?	% Solids	pH:	Flash Point
Black/Grey	None	<input type="checkbox"/> YES or <input checked="" type="checkbox"/> NO	100	7.5	n/a °F

**Attach Laboratory Analytical Report (and/or Material Safety Data Sheet) Including Chain of Custody and Required Parameters Provided for this Profile**

Does this waste or generating process contain regulated concentrations of the following Pesticides and/or Herbicides: Chlordane, Endrin, Heptachlor (and its epoxides), Lindane, Methoxychlor, Toxaphene, 2,4-D, or 2,4,5-TP Silvex as defined in 40 CFR 261.33?	<input type="checkbox"/> Yes or <input checked="" type="checkbox"/> No
Does this waste contain reactive sulfides (greater than 500 ppm) or reactive cyanide (greater than 250 ppm)[reference 40 CFR 261.23(a)(5)]?	<input type="checkbox"/> Yes or <input checked="" type="checkbox"/> No
Does this waste contain regulated concentrations of Polychlorinated Biphenyls (PCBs) as defined in 40 CFR Part 761?	<input type="checkbox"/> Yes or <input checked="" type="checkbox"/> No
Does this waste contain concentrations of listed hazardous wastes defined in 40 CFR 261.31, 261.32, 261.33, including RCRA F-Listed Solvents?	<input type="checkbox"/> Yes or <input checked="" type="checkbox"/> No
Does this waste exhibit a Hazardous Characteristic as defined by Federal and/or State regulations?	<input type="checkbox"/> Yes or <input checked="" type="checkbox"/> No
Does this waste contain regulated concentrations of 2,3,7,8-Tetrachlorodibenzodioxin (2,3,7,8-TCDD), or any other dioxin as defined in 40 CFR 261.31?	<input type="checkbox"/> Yes or <input checked="" type="checkbox"/> No
Is this a regulated Radioactive Waste as defined by Federal and/or State regulations?	<input type="checkbox"/> Yes or <input checked="" type="checkbox"/> No
Is this a regulated Medical or Infectious Waste as defined by Federal and/or State regulations?	<input type="checkbox"/> Yes or <input checked="" type="checkbox"/> No
Is this waste a reactive or heat generating waste?	<input type="checkbox"/> Yes or <input checked="" type="checkbox"/> No
Does the waste contain sulfur or sulfur by-products?	<input type="checkbox"/> Yes or <input checked="" type="checkbox"/> No
Is this waste generated at a Federal Superfund Clean Up Site?	<input type="checkbox"/> Yes or <input checked="" type="checkbox"/> No
Is this waste from a TSD facility, TSD like facility or consolidator?	<input type="checkbox"/> Yes or <input checked="" type="checkbox"/> No

**VI. Certification**

I hereby certify that to the best of my knowledge and belief, the information contained herein is a true, complete and accurate description of the waste material being offered for disposal and all known or suspected hazards have been disclosed. All Analytical Results/Material Safety Data Sheets submitted are truthful and complete and are representative of the waste.

I further certify that by utilizing this profile, neither myself nor any other employee of the company will deliver for disposal or attempt to deliver for disposal any waste which is classified as toxic waste, hazardous waste or infectious waste, or any other waste material this facility is prohibited from accepting by law. I shall immediately give written notice of any change or condition pertaining to the waste not provided herein. Our company hereby agrees to fully indemnify this disposal facility against any damages resulting from this certification being inaccurate or untrue.

I further certify that the company has not altered the form or content of this profile sheet as provided by Republic Services Inc.

Vernon Uy, Project Engineer

American Construction Company, Inc.

Authorized Representative Name And Title (Type or Print)

Company Name

Authorized Representative Signature

2/24/15

Date

LW-15021

Ticket Date	Facility & Ticket Number		Customer	Truck	Material	Contract Rate		Billing Quantity		Ordered Quantity	Minimum Quantity	Maximum Quantity	Material Total	Tax Total	Total
02/13/2015 I	3A	327979	012466 - American Construction	PGH	Trucking	135.00	F	16.25	HR	0.00	\$0.00	\$0.00	\$2,193.75	\$78.98	\$2,272.73
03/02/2015 I	7A	265764	012466 - American Construction	7328	Dredge Spoils	0.00	S	20.51	TN	0.00	\$1,115.00	\$0.00	\$1,115.00	\$0.00	\$1,115.00
03/02/2015 I	7A	265771	012466 - American Construction	7330	Dredge Spoils	0.00	S	19.74	TN	0.00	\$1,115.00	\$0.00	\$1,115.00	\$0.00	\$1,115.00
03/02/2015 I	7A	265772	012466 - American Construction	0329	Dredge Spoils	0.00	S	19.37	TN	0.00	\$1,115.00	\$0.00	\$1,115.00	\$0.00	\$1,115.00
03/02/2015 I	7A	265774	012466 - American Construction	7331	Dredge Spoils	0.00	S	19.48	TN	0.00	\$1,115.00	\$0.00	\$1,115.00	\$0.00	\$1,115.00
03/02/2015 I	7A	265776	012466 - American Construction	5833	Dredge Spoils	0.00	S	18.70	TN	0.00	\$1,115.00	\$0.00	\$1,115.00	\$0.00	\$1,115.00
03/05/2015 I	7A	265788	012466 - American Construction	5833	Dredge Spoils	0.00	S	19.74	TN	0.00	\$1,115.00	\$0.00	\$1,115.00	\$0.00	\$1,115.00
03/05/2015 I	7A	265789	012466 - American Construction	6180	Dredge Spoils	0.00	S	21.10	TN	0.00	\$1,115.00	\$0.00	\$1,115.00	\$0.00	\$1,115.00
03/09/2015 I	7A	265847	012466 - American Construction	7329	Dredge Spoils	0.00	S	21.68	TN	0.00	\$1,115.00	\$0.00	\$1,115.00	\$0.00	\$1,115.00

Tickets Reported:9Items Reported:9

Contract Totals:\$11,113.75\$78.98\$11,192.73

Material Summary	Weight		Volume		Count		Billing Quantity	Material Total	Tax Total	Total
	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound				
76 - Dredge Spoils	160.32	0.00 TN	224.00	0.00 YD	0.00	0.00	160.32 TN	\$8,920.00	\$0.00	\$8,920.00
TR - Trucking	0.00	0.00 TN	0.00	0.00 YD	16.25	0.00	16.25 HR	\$2,193.75	\$78.98	\$2,272.73

Cash Totals:\$0.00\$0.00\$0.00

Invoice Totals:\$11,113.75\$78.98\$11,192.73

Tickets Reported:9Items Reported:9Report Totals:\$11,113.75\$78.98\$11,192.73



ITE  
 Roosevelt Landfill  
 500 Roosevelt Grade Rd  
 Roosevelt Wa, 99356  
 CUSTOMER  
 012466  
 American Construction  
 1501 Taylor Way  
 Tacoma, WA 98421  
 LW-15021

SITE 7A	TICKET # 265764	CELL
WEIGHMASTER Gail H.		
DATE/TIME IN 03-02-2015 12:51 pm		DATE/TIME OUT 03-2-2015 1:14 pm
VEHICLE 7328		CONTAINER RBSU200209
REFERENCE INVOICE		
BILL OF LADING BNSF230136 02/27/2015 0		

SCALE IN	GROSS WEIGHT	87,900	NET TONS	20.51	
SCALE OUT	TARE WEIGHT	46,880	NET WEIGHT	41,020	INBOUND

QTY.	UNIT	DESCRIPTION	RATE	EXTENSION	TAX	TOTAL
28.00	YD	TRACKING QTY				
20.51	TN	Dredge Spoils Tacoma				

The undersigned individual signing this document on behalf of Customer acknowledges that he or she has read and understands the terms and conditions on the reverse side and that he or she has the authority to sign this document on behalf of the customer.

RS-F042UPR (07/12)

SIGNATURE \_\_\_\_\_

NET AMOUNT
TENDERED
CHANGE
CHECK#

<b>SITE</b> Roosevelt Landfill 500 Roosevelt Grade Rd Roosevelt Wa, 99356
<b>CUSTOMER</b> 012466 American Construction 1501 Taylor Way Tacoma, WA 98421 LW-15021

<b>SITE</b> 7A	<b>TICKET #</b> 265771	<b>CELL</b>
<b>WEIGHMASTER</b> Gail H.		
<b>DATE/TIME IN</b> 03-02-2015 12:59 pm		<b>DATE/TIME OUT</b> 03-2-2015 1:40 pm
<b>VEHICLE</b> 7330		<b>CONTAINER</b> RBSU200056
<b>REFERENCE</b>		
<b>BILL OF LADING</b> BNSF230136 02/27/2015 0		

SCALE IN	GROSS WEIGHT	88,680	NET TONS	19.74	
SCALE OUT	TARE WEIGHT	49,200	NET WEIGHT	39,480	INBOUND

QTY.	UNIT	DESCRIPTION	RATE	EXTENSION	TAX	TOTAL
28.00	YD	TRACKING QTY				
19.74	TN	Dredge Spoils Tacoma				

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RS-F042UPR (07/12)

SIGNATURE \_\_\_\_\_

<b>NET AMOUNT</b>
TENDERED
CHANGE
CHECK#

**SITE**  
 Roosevelt Landfill  
 500 Roosevelt Grade Rd  
 Roosevelt Wa, 99356  
**CUSTOMER**  
 012466  
 American Construction  
 1501 Taylor Way  
 Tacoma, WA 98421  
 LW-15021

<b>SITE</b> 7A	<b>TICKET #</b> 265772	<b>CELL</b>
<b>WEIGHMASTER</b> Gail H.		
<b>DATE/TIME IN</b> 03-02-2015 1:10 pm	<b>DATE/TIME OUT</b> 03-2-2015 1:42 pm	
<b>VEHICLE</b> 0329	<b>CONTAINER</b> RBSU200119	
<b>REFERENCE</b>		
<b>BILL OF LADING</b> BNSF230136 02/27/2015 0		

SCALE IN	GROSS WEIGHT	87,220	NET TONS	19.37	
SCALE OUT	TARE WEIGHT	48,480	NET WEIGHT	38,740	INBOUND

QTY.	UNIT	DESCRIPTION	RATE	EXTENSION	TAX	TOTAL
28.00	YD	TRACKING QTY				
19.37	TN	Dredge Spoils Tacoma				

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RS-F042UPR (07/12)

SIGNATURE \_\_\_\_\_

<b>NET AMOUNT</b>
TENDERED
CHANGE
CHECK#

**SITE**  
 Roosevelt Landfill  
 500 Roosevelt Grade Rd  
 Roosevelt Wa, 99356  
**CUSTOMER**  
 012466  
 American Construction  
 1501 Taylor Way  
 Tacoma, WA 98421  
 LW-15021

<b>SITE</b> 7A	<b>TICKET #</b> 265774	<b>CELL</b>
<b>WEIGHMASTER</b> Gail H.		
<b>DATE/TIME IN</b> 03-02-2015 1:09 pm		<b>DATE/TIME OUT</b> 03-2-2015 1:44 pm
<b>VEHICLE</b> 7331		<b>CONTAINER</b> EGT0420799
<b>REFERENCE</b> INVOICE		
<b>BILL OF LADING</b> BNSF230136 02/27/2015 0		

SCALE IN	GROSS WEIGHT	86,300	NET TONS	19.48	
SCALE OUT	TARE WEIGHT	47,340	NET WEIGHT	38,960	INBOUND

QTY.	UNIT	DESCRIPTION	RATE	EXTENSION	TAX	TOTAL
28.00	YD	TRACKING QTY				
19.48	TN	Dredge Spoils Tacoma				

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RS-F042UPR (07/12)

SIGNATURE \_\_\_\_\_

<b>NET AMOUNT</b>
TENDERED
CHANGE
CHECK#

**SITE**  
 Roosevelt Landfill  
 500 Roosevelt Grade Rd  
 Roosevelt Wa, 99356  
**CUSTOMER**  
 012466  
 American Construction  
 1501 Taylor Way  
 Tacoma, WA 98421  
 LW-15021

<b>SITE</b> 7A	<b>TICKET #</b> 265776	<b>CELL</b>
<b>WEIGHMASTER</b> Gail H.		
<b>DATE/TIME IN</b> 03-02-2015 1:19 pm	<b>DATE/TIME OUT</b> 03-2-2015 1:50 pm	
<b>VEHICLE</b> 5833	<b>CONTAINER</b> RBS0200221	
<b>REFERENCE</b>		
<b>BILL OF LADING</b> BNSF230136 02/27/2015 0		

SCALE IN	GROSS WEIGHT	85,080	NET TONS	18.70	
SCALE OUT	TARE WEIGHT	47,680	NET WEIGHT	37,400	INBOUND

QTY.	UNIT	DESCRIPTION	RATE	EXTENSION	TAX	TOTAL
28.00	YD	TRACKING QTY				
18.70	TN	Dredge Spoils Tacoma				

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RS-F042UPR (07/12)

SIGNATURE \_\_\_\_\_

<b>NET AMOUNT</b>
TENDERED
CHANGE
CHECK#



SITE	Roosevelt Landfill
	500 Roosevelt Grade Rd Roosevelt Wa, 99356
CUSTOMER	012466
	American Construction 1501 Taylor Way Tacoma, WA 98421 LW-15021

SITE	7A	TICKET #	265788	CELL	
WEIGHMASTER Gail H.					
DATE/TIME IN		03-05-2015 6:36 am		DATE/TIME OUT 03-05-2015 7:02 am	
VEHICLE		9835		CONTAINER RBS0200231	
REFERENCE				INVOICE	
BILL OF LADING		BNSF231197		03/02/2015 0	

SCALE IN	GROSS WEIGHT	87,720	NET TONS	19.74	
SCALE OUT	TARE WEIGHT	48,240	NET WEIGHT	39,480	INBOUND

QTY	UNIT	DESCRIPTION	RATE	EXTENSION	TAX	TOTAL
28.00	YD	TRACKING QTY				
19.74	TN	Dredge Spoils Tacoma				

NET AMOUNT
TENDERED
CHANGE
CHECK#

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RS-F042UPR (07/12)

SIGNATURE \_\_\_\_\_

**SITE** Roosevelt Landfill  
 500 Roosevelt Grade Rd  
 Roosevelt Wa, 99356  
**CUSTOMER** 012466  
 American Construction  
 1501 Taylor Way  
 Tacoma, WA 98421  
 LW-15021

<b>SITE</b> 7A	<b>TICKET #</b> 265789	<b>CELL</b>
<b>WEIGHMASTER</b> Gail H.		
<b>DATE/TIME IN</b> 03-05-2015 6:34 am	<b>DATE/TIME OUT</b> 03-5-2015 7:06 am	
<b>VEHICLE</b> 6180	<b>CONTAINER</b> RBS0200247	
<b>REFERENCE</b>		<b>INVOICE</b>
<b>BILL OF LADING</b> BNSF231197		03/02/2015 0

SCALE IN	GROSS WEIGHT	88,780	NET TONS	21.10	
SCALE OUT	TARE WEIGHT	46,580	NET WEIGHT	42,200	INBOUND

QTY	UNIT	DESCRIPTION	RATE	EXTENSION	TAX	TOTAL
28.00	YD	TRACKING QTY				
21.10	TN	Dredge Spoils Tacoma				

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RS-F042UPR (07/12)

SIGNATURE \_\_\_\_\_

<b>NET AMOUNT</b>
TENDERED
CHANGE
CHECK#

<b>SITE</b> Roosevelt Landfill 500 Roosevelt Grade Rd Roosevelt Wa, 99356
<b>CUSTOMER</b> 012466 American Construction 1501 Taylor Way Tacoma, WA 98421 LW-15021

<b>SITE</b> 7A	<b>TICKET #</b> 265847	<b>CELL</b>
<b>WEIGHMASTER</b> Gail H.		
<b>DATE/TIME IN</b> 03-09-2015 12:03 pm		<b>DATE/TIME OUT</b> 03-9-2015 12:32 pm
<b>VEHICLE</b> 7329		<b>CONTAINER</b> RBSU200211
<b>REFERENCE</b>		
<b>BILL OF LADING</b> DTTX27601 03/04/2015 0		

SCALE IN	GROSS WEIGHT	89,960	NET TONS	21.68	
SCALE OUT	TARE WEIGHT	46,600	NET WEIGHT	43,360	INBOUND

QTY.	UNIT	DESCRIPTION	RATE	EXTENSION	TAX	TOTAL
28.00	YD	TRACKING QTY				
21.68	TN	Dredge Spoils Tacoma				

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RS-F042UPR (07/12)

SIGNATURE \_\_\_\_\_

<b>NET AMOUNT</b>
TENDERED
CHANGE
CHECK#

SITE	Roosevelt Landfill 500 Roosevelt Grade Rd Roosevelt Wa, 99356
CUSTOMER	012466 American Construction 1501 Taylor Way Tacoma, WA 98421 TB-12147

SITE	7A	TICKET	265883	CELL	
WEIGHMASTER Beckey V.					
DATE/TIME IN		03-11-2015	1:01 pm	DATE/TIME OUT 03-11-2015 1:26 pm	
VEHICLE		0352	CONTAINER		RABU483174
REFERENCE				INVOICE	
BILL OF LADING		BNSF230090		03/09/2015 0	

SCALE IN	GROSS WEIGHT	108,840	NET TONS	30.12	
SCALE OUT	TARE WEIGHT	48,600	NET WEIGHT	60,240	INBOUND

QTY.	UNIT	DESCRIPTION	RATE	EXTENSION	TAX	TOTAL
30.12	TN	TRACKING QTY				
1.00		Creosote				
		CONTAINER/CHASIS RENTAL				

NET AMOUNT
TENDERED
CHANGE
CHECK#

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RS-F042UPR (07/12) SIGNATURE \_\_\_\_\_

**Murray Morgan Bridge Remedial Action**

**Remedial Action  
Construction Report**

**Appendix F  
Post-Dredge and Post-Remedial Action  
Confirmational Sampling Field Forms**



# SURFACE SEDIMENT SAMPLE COLLECTION FORM

## Murray Morgan Bridge Remedial Action Confirmational Sediment Sampling

Date: 2/7/15

Weather: rainy

Field Personnel: Amanda McKay, Eric Parker, Steve

### Sample Type:

☒ 1. Surface Grab (0-10 cm)

Sample Designation: MMB-PD1

Sample Method (Van Veen Surface Grab/Slope Composite)

Datum (Horizontal/Vertical): GPS not working - sea below

Sample Types 1, 2, 3, 4, 5:

\*If sample type 4, were reference samples collected? ☐ Yes ☐ No

Leadline Water Dept: 37.1 (A)

Predicted Tide Elevation: 3.951 (B)

Mudline Elevation: -31.7 (B-A)

Actual Tide Elevation: 5.328

Run # or Composite Pt	Time	Latitude (Northing)	Longitude (Easting)	Sample Criteria (Surface Grab Only)					Accept Sample Y/N	Comments (Include depth of sample)
				1	2	3	4	5		
1	10:35	sea below		✓	✓	✓	✓	✓	Y	12cm

Acceptance criteria: 1 Overlying water is present, 2 Water has low turbidity, 3 Sampler is not over filled, 4 Sample surface is flat, 5 Desired sample depth is reached

### Sediment Sample Description

Sediment Sample Description (density, moisture, color, minor constituents, major constituents, other observations; \*see field ref cards):

~1cm dark brown fine silt on surface, below dark brown silt w/ some fine sand and trace coarse sand,

Sample containers filled (number and type):

1 - 802

no debris, moderate H<sub>2</sub>S odor, no sheen

Laboratory analysis:

metals (Hg, Cu, Zn, Pb), TOC, total solids

### Comments:

15' S  
33' S

215' east of bridge, ~33' south of north end of bridge - slightly past 30' mark on bridge

# SURFACE SEDIMENT SAMPLE COLLECTION FORM

## Murray Morgan Bridge Remedial Action Confirmational Sediment Sampling

Date: 2/7/15

Weather: raining

Field Personnel: Amanda Mckay, Eric Parker, Steve

### Sample Type:

☒ 1. Surface Grab (0-10 cm)

Sample Designation

MMB-PD2

Sample Method (Van Veen Surface Grab/Slope Composite)

Datum (Horizontal/Vertical) NO GPS - approx 15' east of bridge, between 60-70'

Sample Types 1, 2, 3, 4, 5:

\*If sample type 4, were reference samples collected? ☐ Yes ☐ No

Leadline Water Dept: 35.5 (A)

Predicted Tide Elevation 5.398 (B)

Mudline Elevation -28.7 (B-A)

Actual Tide Elevation 6.729

marks on bridge

Run # or Composite Pt	Time	Latitude (Northing)	Longitude (Easting)	Sample Criteria (Surface Grab Only)					Accept Sample Y/N	Comments (Include depth of sample)
				1	2	3	4	5		
<u>1</u>	<u>11:00</u>	<u>see above</u>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			<u>N</u>	
<u>2</u>	<u>11:10</u>			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<u>Y</u>	<u>11 cm</u>

Acceptance criteria: 1 Overlying water is present, 2 Water has low turbidity, 3 Sampler is not over filled, 4 Sample surface is flat, 5 Desired sample depth is reached

### Sediment Sample Description

Sediment Sample Description (density, moisture, color, minor constituents, major constituents, other observations; \*see field ref cards):

21 cm fine dark brown silt on surface, fine sand, silt w/ trace coarse sand, no odor, clam shells (3-4), below mentioned

Sample containers filled (number and type):

NO SCREEN  
2- 802 jars (duplicate)

Laboratory analysis:

metals (Hg, Cu, Zn, Pb), TOC, total solids

Comments:

collected duplicate @ 11:15

# SURFACE SEDIMENT SAMPLE COLLECTION FORM

Murray Morgan Bridge Remedial Action  
Confirmational Sediment Sampling

Date: 2/14/15

Weather: cloudy

Field Personnel: A. McKay, E. Parker, Andrew

Sample Type:

☒ 1. Surface Grab (0-10 cm)

Sample Designation PC-1-021415

Sample Method (Van Veen Surface Grab/Slope Composite) power grab

Datum (Horizontal/Vertical) - MLLW

Sample Types 1, 2, 3, 4, 5:

\*If sample type 4, were reference samples collected? ☐ Yes ☐ No

Leadline Water Dept: 34.3 (A)

Predicted Tide Elevation 8.833 (B)

Mudline Elevation -25.08 (B-A)

Actual Tide Elevation 9.216

Run # or Composite Pt	Time	Latitude (Northing)	Longitude (Easting)	Sample Criteria (Surface Grab Only)					Accept Sample Y/N	Comments (Include depth of sample)
				1	2	3	4	5		
1	12:20	see below		✓	✓	✓	✓	✓	Y	~30 cm 10 cm sample

Acceptance criteria: 1 Overlying water is present, 2 Water has low turbidity, 3 Sampler is not over filled, 4 Sample surface is flat, 5 Desired sample depth is reached

## Sediment Sample Description

Sediment Sample Description (density, moisture, color, minor constituents, major constituents, other observations; \*see field ref cards):

cap material - sand fine to coarse  
grey and brown, trace black flecks - AC?, no odor

Sample containers filled (number and type):

am 4 2-1802, 2-3202 2-802, 2-3202  
AM

Laboratory analysis:

metals (Cu, Zn, Pb, Hg), TOC, total solids  
grain size Duplicate collected - 12:30

Comments:

Location - ~15 ft east of  
abutment, between 30-40 south  
of north side of abutment

# SURFACE SEDIMENT SAMPLE COLLECTION FORM

## Murray Morgan Bridge Remedial Action Confirmational Sediment Sampling

Date: 2/4/15

Weather: Cloudy

Field Personnel: A. Mykoj, E. Parker  
Andrew

Sample Type:

☒ 1. Surface Grab (0-10 cm)

Sample Designation

PC-2-021415

Sample Method (Van Veen Surface Grab/Slope Composite)

power grab

Datum (Horizontal/Vertical)

- , MLLW

Sample Types 1, 2, 3, 4, 5:

\*If sample type 4, were reference samples collected? ☐ Yes ☐ No

Leadline Water Dept: 35.3 (A)

Predicted Tide Elevation 8.533 (B)

Mudline Elevation -26.35 (B-A)

Actual Tide Elevation 8.953

Run # or Composite Pt	Time	Latitude (Northing)	Longitude (Easting)	Sample Criteria (Surface Grab Only)					Accept Sample Y/N	Comments (Include depth of sample)
				1	2	3	4	5		
1	12:40	see below		✓	✓	✓	-	✓	Y	-25-30 cm 10 cm sq

Acceptance criteria: 1 Overlying water is present, 2 Water has low turbidity, 3 Sampler is not over filled, 4 Sample surface is flat, 5 Desired sample depth is reached

### Sediment Sample Description

Sediment Sample Description (density, moisture, color, minor constituents, major constituents, other observations; \*see field ref cards):

gray and sand cap material - fine to coarse sand, trace brown black flecks activated carbon?, no odor

Sample containers filled (number and type):

1 - 8oz 1 - 32oz

Laboratory analysis:

metal (Cu, Zn, Pb, Hg), TOC, total solids, grain size

Comments:

~15 ft East of abutment between  
60-70 ft south of north end of  
abutment (~65 ft)

# SURFACE SEDIMENT SAMPLE COLLECTION FORM

## Murray Morgan Bridge Remedial Action Confirmational Sediment Sampling

Date: 2/14/15

Weather: cloudy

Field Personnel: E. Parker, A. Mykoy, Andrew

### Sample Type:

☒ 1. Surface Grab (0-10 cm)

Sample Designation

MMB-6-D1

Sample Method (Van Veen Surface Grab/Slope Composite)

Datum (Horizontal/Vertical)

State plane, MLLW

Sample Types 1, 2, 3, 4, 5:

\*If sample type 4, were reference samples collected? ☐ Yes ☐ No

Leadline Water Depth

35.1 (A) 35.2

Predicted Tide Elevation

8.386 (B)

Mudline Elevation

-26.4 (B-A)

Actual Tide Elevation

8.77

Run # or Composite Pt	Time	Latitude (Northing)	Longitude (Easting)	Sample Criteria (Surface Grab Only)					Accept Sample Y/N	Comments (Include depth of sample)
				1	2	3	4	5		
1	12:50	706209.4	1160213.5	✓	✓	✓	✓	✓	N	cap material -
2	12:55	706198.5	1160217.3	✓	✓	✓	✓	✓	Y	~35 cm sand
										material -
										~10 cm sample

Acceptance criteria: 1 Overlying water is present, 2 Water has low turbidity, 3 Sampler is not over filled, 4 Sample surface is flat, 5 Desired sample depth is reached

### Sediment Sample Description

Sediment Sample Description (density, moisture, color, minor constituents, major constituents, other observations; \*see field ref cards):

light brown  
1-2cm top layer of silt w/ trace sand, 2-10 cm  
dark brown silt w/ sand - fine, no odor, no sheer  
sand

Sample containers filled (number and type):

1-802 1-32 oz

Laboratory analysis:

metals, TOC, total solids, grain size  
(Cu, Zn, Pb, Hg)

Comments:

10 cm sample



# SURFACE SEDIMENT SAMPLE COLLECTION FORM

## Murray Morgan Bridge Remedial Action Confirmational Sediment Sampling

Date: 2/14/15

Weather: Sunny w/ some clouds

Field Personnel: A McKay, E. Parke,

Andrew

### Sample Type:

☒ 1. Surface Grab (0-10 cm)

Sample Designation

MMB-6-V1

Sample Method (Van Veen Surface Grab/Slope Composite)

power grab

Datum (Horizontal/Vertical)

State plane, MLLW

Sample Types 1, 2, 3, 4, 5:

\*If sample type 4, were reference samples collected? ☐ Yes ☐ No

Leadline Water Depth: 34.6 (A) 34.5

Predicted Tide Elevation 7.991 (B)

Mudline Elevation -26.2 (B-A)

Actual Tide Elevation 8.271

Run # or Composite Pt	Time	Latitude (Northing)	Longitude (Easting)	Sample Criteria (Surface Grab Only)					Accept Sample Y/N	Comments (Include depth of sample)
				1	2	3	4	5		
<u>1</u>	<u>13:25</u>	<u>no coordinates</u>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<u>N</u>	<u>cap material</u>
<u>2</u>	<u>13:30</u>	<u>706236.2</u>	<u>1160261.9</u>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<u>Y</u>	<u>~35 cm material</u>

Acceptance criteria: 1 Overlying water is present, 2 Water has low turbidity, 3 Sampler is not over filled, 4 Sample surface is flat, 5 Desired sample depth is reached

### Sediment Sample Description

Sediment Sample Description (density, moisture, color, minor constituents, major constituents, other observations; \*see field ref cards):

1-2 cm light brown sandy silt, no odor, no sheen,  
2-10 cm dark brown / gray silt w/ fine sand, no odor

Sample containers filled (number and type):

1- 8oz, 1- 32 oz 10 cm sample

Laboratory analysis:

metals (Cu, Zn, Pb, Hg), TOC, total solids,  
grain size

Comments:

Attempt 1 - ~40 ft west of bridge, in line with  
south end of bridge  
Attempt 2 - see coordinates

# SURFACE SEDIMENT SAMPLE COLLECTION FORM

## Murray Morgan Bridge Remedial Action Confirmational Sediment Sampling

Date: 2/14/15

Weather: Sunny, slightly overcast

Field Personnel: E. Parker, A. McCoy, Andrew

### Sample Type:

☒ 1. Surface Grab (0-10 cm)

Sample Designation MMB-6-D7

Sample Method (Van Veen Surface Grab/Slope Composite) power grab

Datum (Horizontal/Vertical) stake plane, MLLW

Sample Types 1, 2, 3, 4, 5:

\*If sample type 4, were reference samples collected? ☐ Yes ☐ No

Leadline Water Depth: 39.7 (A) 38.9 (2)

Predicted Tide Elevation 2.679 (B)

Mudline Elevation -30.9 (B-A)

Actual Tide Elevation 2.959

Run # or Composite Pt	Time	Latitude (Northing)	Longitude (Easting)	Sample Criteria (Surface Grab Only)					Accept Sample Y/N	Comments (Include depth of sample)
				1	2	3	4	5		
1	14:00	706318.2	1160236.5	✓	✓	✓	✓	✓	N	see below
2	14:15	706335.1	1160224.5	✓	✓	✓	✓	✓	Y	~35 cm

Acceptance criteria: 1 Overlying water is present, 2 Water has low turbidity, 3 Sampler is not over filled, 4 Sample surface is flat, 5 Desired sample depth is reached

### Sediment Sample Description

Sediment Sample Description (density, moisture, color, minor constituents, major constituents, other observations; \*see field ref cards):

top ~ 1 cm light brown sandy silt, no black flecks, fine  
observed, ~ 1-10 cm dark brown silt w/ sand, sticky.  
 Sample containers filled (number and type): clam shell, no odor, small  
1- 8oz, 1 32 oz piece of plastic debris  
10 cm sample

Laboratory analysis:

metals (Cu, Zn, Pb, Hg), TOC, total solids,  
grain size

### Comments:

① Attempt 1 appeared to have a thin layer of fine sand w/ black flecks that may have been AC? Decided to move out a bit further

**Murray Morgan Bridge Remedial Action**

**Remedial Action  
Construction Report**

**Appendix G  
Post-Dredge and Post-Remedial Action  
Confirmational Sampling Laboratory Reports**



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**Floyd | Snider**

Amanda Mckay  
601 Union St., Suite 600  
Seattle, WA 98101

**RE: COT-MMB**

**Lab ID: 1502094**

February 11, 2015

**Attention Amanda Mckay:**

Fremont Analytical, Inc. received 4 sample(s) on 2/9/2015 for the analyses presented in the following report.

***Mercury by EPA Method 245.1***

***Mercury by EPA Method 7471***

***Sample Moisture (Percent Moisture)***

***Total Metals by EPA Method 200.8***

***Total Metals by EPA Method 6020***

***Total Organic Carbon by EPA Method 9060***

This report consists of the following:

- Case Narrative
- Analytical Results
- Applicable Quality Control Summary Reports
- Chain of Custody

All analyses were performed consistent with the Quality Assurance program of Fremont Analytical, Inc. Please contact the laboratory if you should have any questions about the results.

Thank you for using Fremont Analytical.

Sincerely,

Mike Ridgeway  
President



Date: 02/11/2015

**CLIENT:** Floyd | Snider  
**Project:** COT-MMB  
**Lab Order:** 1502094

## Work Order Sample Summary

Lab Sample ID	Client Sample ID	Date/Time Collected	Date/Time Received
1502094-001	MMB-PD1	02/07/2015 10:35 AM	02/09/2015 8:25 AM
1502094-002	MMB-PD2	02/07/2015 11:10 AM	02/09/2015 8:25 AM
1502094-003	MMB-DUP	02/07/2015 11:15 AM	02/09/2015 8:25 AM
1502094-004	MMB-Rinsate	02/07/2015 11:40 AM	02/09/2015 8:25 AM

Note: If no "Time Collected" is supplied, a default of 12:00AM is assigned



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**CLIENT:** Floyd | Snider**Project:** COT-MMB

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**I. SAMPLE RECEIPT:**

Samples receipt information is recorded on the attached Sample Receipt Checklist.

**II. GENERAL REPORTING COMMENTS:**

Results are reported on a wet weight basis unless dry-weight correction is denoted in the units field on the analytical report ("mg/kg-dry" or "ug/kg-dry").

Matrix Spike (MS) and MS Duplicate (MSD) samples are tested from an analytical batch of "like" matrix to check for possible matrix effect. The MS and MSD will provide site specific matrix data only for those samples which are spiked by the laboratory. The sample chosen for spike purposes may or may not have been a sample submitted in this sample delivery group. The validity of the analytical procedures for which data is reported in this analytical report is determined by the Laboratory Control Sample (LCS) and the Method Blank (MB). The LCS and the MB are processed with the samples and the MS/MSD to ensure method criteria are achieved throughout the entire analytical process.

**III. ANALYSES AND EXCEPTIONS:**

Exceptions associated with this report will be footnoted in the analytical results page(s) or the quality control summary page(s) and/or noted below.



## Analytical Report

WO#: 1502094

Date Reported: 2/11/2015

Client: Floyd | Snider

Collection Date: 2/7/2015 10:35:00 AM

Project: COT-MMB

Lab ID: 1502094-001

Matrix: Sediment

Client Sample ID: MMB-PD1

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
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### Mercury by EPA Method 7471

Batch ID: 10010 Analyst: MW

Mercury	1.07	0.382		mg/Kg-dry	1	2/10/2015 4:45:19 PM
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### Total Metals by EPA Method 6020

Batch ID: 10008 Analyst: TN

Copper	106	0.291		mg/Kg-dry	1	2/10/2015 4:38:59 PM
Lead	646	0.291		mg/Kg-dry	1	2/10/2015 4:38:59 PM
Zinc	220	0.727		mg/Kg-dry	1	2/10/2015 4:38:59 PM

### Sample Moisture (Percent Moisture)

Batch ID: R20559 Analyst: SB

Percent Moisture	43.6			wt%	1	2/10/2015 1:05:25 PM
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### Total Organic Carbon by EPA Method 9060

Batch ID: 10019 Analyst: KT

Total Organic Carbon	3.70	0.0500		%-dry	1	2/11/2015 6:17:41 PM
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**Qualifiers:** B Analyte detected in the associated Method Blank  
E Value above quantitation range  
J Analyte detected below quantitation limits  
RL Reporting Limit

D Dilution was required  
H Holding times for preparation or analysis exceeded  
ND Not detected at the Reporting Limit  
S Spike recovery outside accepted recovery limits



## Analytical Report

WO#: 1502094

Date Reported: 2/11/2015

Client: Floyd | Snider

Collection Date: 2/7/2015 11:10:00 AM

Project: COT-MMB

Lab ID: 1502094-002

Matrix: Sediment

Client Sample ID: MMB-PD2

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
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### Mercury by EPA Method 7471

Batch ID: 10010 Analyst: MW

Mercury	0.398	0.341		mg/Kg-dry	1	2/10/2015 4:51:48 PM
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### Total Metals by EPA Method 6020

Batch ID: 10008 Analyst: TN

Copper	45.5	0.249		mg/Kg-dry	1	2/10/2015 5:07:15 PM
Lead	60.9	0.249		mg/Kg-dry	1	2/10/2015 5:07:15 PM
Zinc	92.4	0.622		mg/Kg-dry	1	2/10/2015 5:07:15 PM

### Sample Moisture (Percent Moisture)

Batch ID: R20559 Analyst: SB

Percent Moisture	35.7			wt%	1	2/10/2015 1:05:25 PM
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### Total Organic Carbon by EPA Method 9060

Batch ID: 10019 Analyst: KT

Total Organic Carbon	1.20	0.0500		%-dry	1	2/11/2015 6:17:41 PM
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**Qualifiers:** B Analyte detected in the associated Method Blank  
E Value above quantitation range  
J Analyte detected below quantitation limits  
RL Reporting Limit

D Dilution was required  
H Holding times for preparation or analysis exceeded  
ND Not detected at the Reporting Limit  
S Spike recovery outside accepted recovery limits



## Analytical Report

WO#: 1502094

Date Reported: 2/11/2015

Client: Floyd | Snider

Collection Date: 2/7/2015 11:15:00 AM

Project: COT-MMB

Lab ID: 1502094-003

Matrix: Sediment

Client Sample ID: MMB-DUP

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
<b><u>Mercury by EPA Method 7471</u></b>				Batch ID: 10010		Analyst: MW
Mercury	ND	0.384		mg/Kg-dry	1	2/10/2015 4:53:23 PM
<b><u>Total Metals by EPA Method 6020</u></b>				Batch ID: 10008		Analyst: TN
Copper	58.0	0.238		mg/Kg-dry	1	2/10/2015 5:10:47 PM
Lead	71.4	0.238		mg/Kg-dry	1	2/10/2015 5:10:47 PM
Zinc	105	0.595		mg/Kg-dry	1	2/10/2015 5:10:47 PM
<b><u>Sample Moisture (Percent Moisture)</u></b>				Batch ID: R20559		Analyst: SB
Percent Moisture	34.8			wt%	1	2/10/2015 1:05:25 PM
<b><u>Total Organic Carbon by EPA Method 9060</u></b>				Batch ID: 10019		Analyst: KT
Total Organic Carbon	1.32	0.0500		%-dry	1	2/11/2015 6:17:41 PM

**Qualifiers:** B Analyte detected in the associated Method Blank  
E Value above quantitation range  
J Analyte detected below quantitation limits  
RL Reporting Limit

D Dilution was required  
H Holding times for preparation or analysis exceeded  
ND Not detected at the Reporting Limit  
S Spike recovery outside accepted recovery limits



## Analytical Report

WO#: 1502094

Date Reported: 2/11/2015

Client: Floyd | Snider

Collection Date: 2/7/2015 11:40:00 AM

Project: COT-MMB

Lab ID: 1502094-004

Matrix: Water

Client Sample ID: MMB-Rinsate

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
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**Mercury by EPA Method 245.1**

Batch ID: 10002

Analyst: MW

Mercury	ND	0.100		µg/L	1	2/9/2015 5:52:26 PM
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**Total Metals by EPA Method 200.8**

Batch ID: 9999

Analyst: TN

Copper	0.713	0.500		µg/L	1	2/9/2015 5:27:03 PM
Lead	ND	1.00		µg/L	1	2/9/2015 5:27:03 PM
Zinc	3.10	1.50		µg/L	1	2/9/2015 5:27:03 PM

**Qualifiers:** B Analyte detected in the associated Method Blank  
E Value above quantitation range  
J Analyte detected below quantitation limits  
RL Reporting Limit

D Dilution was required  
H Holding times for preparation or analysis exceeded  
ND Not detected at the Reporting Limit  
S Spike recovery outside accepted recovery limits





Date: 2/11/2015

Work Order: 1502094  
CLIENT: Floyd | Snider  
Project: COT-MMB

## QC SUMMARY REPORT

### Total Organic Carbon by EPA Method 9060

Sample ID	MB-10019	SampType:	MBLK			Units:	% -dry			Prep Date:	2/11/2015		RunNo:	20661	
Client ID:	MBLKS	Batch ID:	10019						Analysis Date:	2/11/2015			SeqNo:	392418	
Analyte		Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val		%RPD	RPDLimit	Qual		

Total Organic Carbon	ND	0.0500									
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Sample ID	LCS-10019	SampType:	LCS	Units:	%-dry	Prep Date:	2/11/2015	RunNo:	20661		
Client ID:	LCSS	Batch ID:	10019			Analysis Date:	2/11/2015	SeqNo:	392419		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Total Organic Carbon	0.676	0.0500	0.6510	0	104	41.1	157				
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Sample ID	1502094-001ADUP	SampType:	DUP	Units:	%-dry	Prep Date:	2/11/2015	RunNo:	20661		
Client ID:	MMB-PD1	Batch ID:	10019			Analysis Date:	2/11/2015	SeqNo:	392421		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Total Organic Carbon	3.37	0.0500						3.696	9.20	30	
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Sample ID	1502094-001AMS	SampType:	MS	Units:	%-dry	Prep Date:	2/11/2015	RunNo:	20661		
Client ID:	MMB-PD1	Batch ID:	10019			Analysis Date:	2/11/2015	SeqNo:	392422		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Total Organic Carbon	3.95	0.0500	0.5000	3.696	51.4	50.2	118				
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Sample ID	1502094-001AMSD	SampType:	MSD	Units:	%-dry	Prep Date:	2/11/2015	RunNo:	20661		
Client ID:	MMB-PD1	Batch ID:	10019			Analysis Date:	2/11/2015	SeqNo:	392423		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Total Organic Carbon	4.13	0.0500	0.5000	3.696	86.4	50.2	118	3.953	4.33	20	
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**Qualifiers:**

B	Analyte detected in the associated Method Blank	D	Dilution was required	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits	ND	Not detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Limit	S	Spike recovery outside accepted recovery limits



Date: 2/11/2015

Work Order: 1502094  
CLIENT: Floyd | Snider  
Project: COT-MMB

## QC SUMMARY REPORT

Total Metals by EPA Method 200.8

Sample ID	MB-9999	SampType:	MBLK	Units:	µg/L	Prep Date:	2/9/2015	RunNo:	20548		
Client ID:	MBLKW	Batch ID:	9999			Analysis Date:	2/9/2015	SeqNo:	391642		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Copper	ND	0.500									
Lead	ND	1.00									
Zinc	ND	1.50									

Sample ID	LCS-9999	SampType:	LCS	Units:	µg/L	Prep Date:	2/9/2015	RunNo:	20548		
Client ID:	LCSW	Batch ID:	9999	Analysis Date:	2/9/2015	SeqNo:	391643				
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Copper	113	0.500	100.0	0	113	85	115				
Lead	48.9	1.00	50.00	0	97.8	85	115				
Zinc	110	1.50	100.0	0	110	85	115				

Sample ID	1502075-001ADUP	SampType:	DUP	Units:	µg/L	Prep Date:	2/9/2015	RunNo:	20548		
Client ID:	BATCH	Batch ID:	9999			Analysis Date:	2/9/2015	SeqNo:	391645		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Copper	14.6	0.500						14.70	0.834	30	
Lead	5.10	1.00						4.816	5.80	30	
Zinc	101	1.50						102.6	2.01	30	

Sample ID	1502075-001AMS	SampType:	MS	Units:	µg/L	Prep Date:	2/9/2015	RunNo:	20548		
Client ID:	BATCH	Batch ID:	9999			Analysis Date:	2/9/2015	SeqNo:	391646		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Copper	655	0.500	500.0	14.70	128	70	130				
Lead	242	1.00	250.0	4.816	94.7	70	130				
Zinc	648	1.50	500.0	102.6	109	70	130				

**Qualifiers:**

B	Analyte detected in the associated Method Blank	D	Dilution was required	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits	ND	Not detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Limit	S	Spike recovery outside accepted recovery limits



Date: 2/11/2015

Work Order: 1502094  
CLIENT: Floyd | Snider  
Project: COT-MMB

## QC SUMMARY REPORT

Total Metals by EPA Method 200.8

Sample ID	1502075-001AMS	SampType:	MS	Units:	µg/L	Prep Date:	2/9/2015	RunNo:	20548		
Client ID:	BATCH	Batch ID:	9999			Analysis Date:	2/9/2015	SeqNo:	391646		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Sample ID	1502075-001AMSD	SampType: MSD	Units: µg/L			Prep Date: 2/9/2015			RunNo: 20548		
Client ID:	BATCH	Batch ID: 9999				Analysis Date: 2/9/2015			SeqNo: 391647		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Copper	604	0.500	500.0	14.70	118	70	130	654.9	8.13	30	
Lead	243	1.00	250.0	4.816	95.3	70	130	241.5	0.655	30	
Zinc	629	1.50	500.0	102.6	105	70	130	648.2	3.00	30	

**Qualifiers:**

B	Analyte detected in the associated Method Blank	D	Dilution was required	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits	ND	Not detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Limit	S	Spike recovery outside accepted recovery limits



Date: 2/11/2015

Work Order: 1502094  
CLIENT: Floyd | Snider  
Project: COT-MMB

## QC SUMMARY REPORT

### Mercury by EPA Method 245.1

Sample ID	MB-10002	SampType:	MBLK	Units:	µg/L	Prep Date:	2/9/2015	RunNo:	20569			
Client ID:	MBLKW	Batch ID:	10002			Analysis Date:	2/9/2015	SeqNo:	391906			
Analyte		Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Mercury	ND	0.100										
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Sample ID	LCS-10002	SampType: LCS			Units: µg/L	Prep Date: 2/9/2015			RunNo: 20569		
Client ID:	LCSW	Batch ID: 10002			Analysis Date: 2/9/2015			SeqNo: 391907			
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Mercury	2.84	0.100	2.500	0	114	85	115					
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Sample ID	1502094-004ADUP	SampType:	DUP	Units:	µg/L	Prep Date:	2/9/2015	RunNo:	20569			
Client ID:	MMB-Rinsate	Batch ID:	10002			Analysis Date:	2/9/2015	SeqNo:	391909			
Analyte		Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Mercury	ND	0.100							0		20	
---------	----	-------	--	--	--	--	--	--	---	--	----	--

Sample ID	1502094-004AMS	SampType:	MS	Units:	µg/L	Prep Date:	2/9/2015	RunNo:	20569			
Client ID:	MMB-Rinsate	Batch ID:	10002			Analysis Date:	2/9/2015	SeqNo:	391910			
Analyte		Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Mercury	2.57	0.100	2.500	0	103	80	120					
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Sample ID	1502094-004AMSD	SampType:	MSD	Units:	µg/L	Prep Date:	2/9/2015	RunNo:	20569			
Client ID:	MMB-Rinsate	Batch ID:	10002			Analysis Date:	2/9/2015	SeqNo:	391911			
Analyte		Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Mercury	2.89	0.100	2.500	0	116	80	120	2.570	11.7	20		
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**Qualifiers:**

B	Analyte detected in the associated Method Blank	D	Dilution was required	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits	ND	Not detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Limit	S	Spike recovery outside accepted recovery limits



Date: 2/11/2015

Work Order: 1502094  
CLIENT: Floyd | Snider  
Project: COT-MMB

## QC SUMMARY REPORT

### Total Metals by EPA Method 6020

Sample ID	MB-10008	SampType:	MBLK			Units:	mg/Kg			Prep Date:	2/10/2015			RunNo:	20572		
Client ID:	MBLKS	Batch ID:	10008						Analysis Date:	2/10/2015			SeqNo:	391996			
Analyte		Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val		%RPD	RPDLimit	Qual				
Copper		ND	0.200														
Lead		ND	0.200														
Zinc		ND	0.400														

Sample ID	LCS-10008	SampType:	LCS	Units:	mg/Kg	Prep Date:	2/10/2015	RunNo:	20572		
Client ID:	LCSS	Batch ID:	10008			Analysis Date:	2/10/2015	SeqNo:	391997		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Copper	256	0.200	258.0	0	99.2	76	128.3				
Lead	131	0.200	138.0	0	95.2	73.2	127.5				
Zinc	179	0.400	173.0	0	104	69.4	131.2				

Sample ID	1502094-001ADUP	SampType:	DUP	Units:	mg/Kg-dry	Prep Date:	2/10/2015	RunNo:	20572		
Client ID:	MMB-PD1	Batch ID:	10008			Analysis Date:	2/10/2015	SeqNo:	391999		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Copper	106	0.291						106.3	0.105	20	
Lead	320	0.291						646.0	67.4	20	R
Zinc	228	0.581						220.1	3.64	20	

**NOTES:**

R - High RPD observed. The method is in control as indicated by the laboratory control sample (LCS).

Sample ID	1502094-001AMS	SampType:	MS	Units:	mg/Kg-dry	Prep Date:	2/10/2015	RunNo:	20572		
Client ID:	MMB-PD1	Batch ID:	10008			Analysis Date:	2/10/2015	SeqNo:	392001		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Copper	180	0.291	72.65	106.3	101	75	125				
Lead	381	0.291	36.33	646.0	-729	75	125				S

**Qualifiers:**

B Analyte detected in the associated Method Blank  
H Holding times for preparation or analysis exceeded  
R RPD outside accepted recovery limits

D Dilution was required  
J Analyte detected below quantitation limits  
RL Reporting Limit

E Value above quantitation range  
ND Not detected at the Reporting Limit  
S Spike recovery outside accepted recovery limits





Date: 2/11/2015

Work Order: 1502094  
CLIENT: Floyd | Snider  
Project: COT-MMB

## QC SUMMARY REPORT

### Total Metals by EPA Method 6020

Sample ID	1502094-001AMS		SampType:	MS		Units:	mg/Kg-dry		Prep Date:	2/10/2015		RunNo:	20572	
Client ID:	MMB-PD1		Batch ID:	10008					Analysis Date:	2/10/2015		SeqNo:	392001	
Analyte		Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val		%RPD	RPDLimit	Qual	
Zinc		298	0.581	72.65	220.1	108	75	125						

#### NOTES:

S - Analyte concentration was too high for accurate spike recovery.

Sample ID	1502094-001AMSD	SampType:	MSD	Units:	mg/Kg-dry	Prep Date:	2/10/2015	RunNo:	20572		
Client ID:	MMB-PD1	Batch ID:	10008	Analysis Date:				2/10/2015	SeqNo:	392004	
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Copper	161	0.291	72.65	106.3	75.0	75	125	179.6	11.0	20	RS
Lead	658	0.291	36.33	646.0	33.4	75	125	381.0	53.3	20	
Zinc	306	0.581	72.65	220.1	118	75	125	298.2	2.62	20	

#### NOTES:

SR - High RPD and outlying spike recovery observed for Pb due to high analyte concentration.

Sample ID	1502094-001APDS	SampType:	PDS	Units:	mg/Kg-dry	Prep Date:	2/10/2015	RunNo:	20572		
Client ID:	MMB-PD1	Batch ID:	10008			Analysis Date:	2/10/2015	SeqNo:	392005		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	955	0.291	25.0	889	133	80	120				S

#### NOTES:

S - Analyte concentration was too high for accurate spike recovery for Pb.

#### Qualifiers:

B Analyte detected in the associated Method Blank  
H Holding times for preparation or analysis exceeded  
R RPD outside accepted recovery limits

D Dilution was required  
J Analyte detected below quantitation limits  
RL Reporting Limit

E Value above quantitation range  
ND Not detected at the Reporting Limit  
S Spike recovery outside accepted recovery limits



Date: 2/11/2015

Work Order: 1502094  
CLIENT: Floyd | Snider  
Project: COT-MMB

## QC SUMMARY REPORT

### Mercury by EPA Method 7471

Sample ID	MB-10010	SampType:	MBLK	Units:	mg/Kg	Prep Date:	2/10/2015	RunNo:	20570			
Client ID:	MBLKS	Batch ID:	10010			Analysis Date:	2/10/2015	SeqNo:	391926			
Analyte		Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Mercury	ND	0.250										
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Sample ID	LCS-10010	SampType:	LCS	Units:	mg/Kg	Prep Date:	2/10/2015	RunNo:	20570		
Client ID:	LCSS	Batch ID:	10010			Analysis Date:	2/10/2015	SeqNo:	391927		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Mercury	4.97	0.250	5.000	0	99.4	80	120					
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Sample ID	1502094-001ADUP	SampType:	DUP	Units:	mg/Kg-dry	Prep Date:	2/10/2015	RunNo:	20570			
Client ID:	MMB-PD1	Batch ID:	10010			Analysis Date:	2/10/2015	SeqNo:	391929			
Analyte		Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Mercury	1.02	0.382							1.071	5.27	20	
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Sample ID	1502094-001AMS	SampType:	MS	Units:	mg/Kg-dry	Prep Date:	2/10/2015	RunNo:	20570		
Client ID:	MMB-PD1	Batch ID:	10010			Analysis Date:	2/10/2015	SeqNo:	391930		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Mercury	1.62	0.382	0.7641	1.071	71.8	70	130					
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Sample ID	1502094-001AMSD	SampType:	MSD	Units:	mg/Kg-dry	Prep Date:	2/10/2015	RunNo:	20570			
Client ID:	MMB-PD1	Batch ID:	10010			Analysis Date:	2/10/2015	SeqNo:	391931			
Analyte		Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Mercury	1.69	0.389	0.7775	1.071	80.2	70	130	1.620	4.53	20		
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**Qualifiers:**

B	Analyte detected in the associated Method Blank	D	Dilution was required	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits	ND	Not detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Limit	S	Spike recovery outside accepted recovery limits

## Sample Log-In Check List

Client Name: **FS**  
 Logged by: **Kerra Ziegler**

Work Order Number: **1502094**  
 Date Received: **2/9/2015 8:25:00 AM**

### Chain of Custody

1. Is Chain of Custody complete? Yes ☒ No ☐ Not Present ☐  
 2. How was the sample delivered? Client

### Log In

3. Coolers are present? Yes ☒ No ☐ NA ☐  
 4. Shipping container/cooler in good condition? Yes ☒ No ☐  
 5. Custody seals intact on shipping container/cooler? Yes ☐ No ☐ Not Required ☒  
 6. Was an attempt made to cool the samples? Yes ☒ No ☐ NA ☐  
 7. Were all coolers received at a temperature of >0°C to 10.0°C? Yes ☒ No ☐ NA ☐  
 8. Sample(s) in proper container(s)? Yes ☒ No ☐  
 9. Sufficient sample volume for indicated test(s)? Yes ☒ No ☐  
 10. Are samples properly preserved? Yes ☒ No ☐  
 11. Was preservative added to bottles? Yes ☐ No ☒ NA ☐  
 12. Is the headspace in the VOA vials? Yes ☐ No ☐ NA ☒  
 13. Did all samples containers arrive in good condition(unbroken)? Yes ☒ No ☐  
 14. Does paperwork match bottle labels? Yes ☒ No ☐  
 15. Are matrices correctly identified on Chain of Custody? Yes ☒ No ☐  
 16. Is it clear what analyses were requested? Yes ☒ No ☐  
 17. Were all holding times able to be met? Yes ☒ No ☐

### Special Handling (if applicable)

18. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☒

Person Notified:  Date   
 By Whom:  Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person  
 Regarding:   
 Client Instructions:

19. Additional remarks:

### Item Information

Item #	Temp °C	Condition
Cooler 1	1.2	Good
Cooler 2	1.3	Good
Sample 1	1.9	Good
Sample 2	2.6	Good



# Fremont

Analytical

3600 Fremont Ave N.  
Seattle, WA 98103

Tel: 206-352-3790  
Fax: 206-352-7178

## Chain of Custody Record

Laboratory Project No (internal):

1502094

Page:

1

of:

1

Client:

Floyd I Snider

Project Name:

COT-MMB

Address:

601 Union St Suite 600

Location:

Murray Morgan Bridge, Th-u Foss

City, State, Zip

Seattle WA 98101

Tel:

206-242-2078

Collected by:

Amanda McKay

Reports To (PM):

Amanda McKay

Fax:

Email:

amanda.mckay@floyd-snider.com

Project No:

\*Matrix Codes: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, WW = Waste Water

Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	VOC (EPA 8260)	GV/STEX	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCD)	Diesel/Heavy Oil Range Organics (DH)	SEM VOL (EPA 8270)	PAH (EPA 8270 - SIM)	PCBs (EPA 8082)	Metals** (6010 / 200.8)	Total (T) / Dissolved (D)	Anions (8011)	ED06 (8011)	TOC by PSEP	total solids, 160.3	metals (Hg, Cu, Zn, Pb)	Comments/Depth
1 MMB-PD1	2/7/15	10:35	sed												X	X	X			metals - Hg, Cu, Zn, Pb only
2 MMB-PD2		11:10													X	X	X			
3 MMB-BUP		11:15													X	X	X			
4 MMB-Rinse		11:40	water														X			
5																				
6																				
7																				
8																				
9																				
10																				

\*\*Metals Analysis (Circle): MTCA-S RCRA-B Priority Pollutants TAL Individual: Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Se Sr Sn Ti Tl U V Zn

\*\*\*Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Sample Disposal: ☐ Return to Client ☐ Disposal by Lab (A fee may be assessed if samples are retained after 30 days.)

Relinquished

Date/Time

2/7/15 14:00

Received

x

Date/Time

2/9/15 8:25

Relinquished

Date/Time

Received

x

Date/Time

Special Remarks:

2-DAY TAT

TAT -> SameDay<sup>a</sup> NextDay<sup>a</sup> 2 Day 3 Day STD

<sup>a</sup>Please coordinate with the lab in advance



3600 Fremont Ave. N.

Seattle, WA 98103

T: (206) 352-3790

F: (206) 352-7178

[info@fremontanalytical.com](mailto:info@fremontanalytical.com)

**Floyd | Snider**

Amanda McKay  
601 Union St., Suite 600  
Seattle, WA 98101

**RE: COT-MMB**

**Lab ID: 1502167**

February 17, 2015

**Attention Amanda McKay:**

Fremont Analytical, Inc. received 7 sample(s) on 2/16/2015 for the analyses presented in the following report.

***Grain Size by ASTM D422***

***Mercury by EPA Method 245.1***

***Mercury by EPA Method 7471***

***Sample Moisture (Percent Moisture)***

***Total Metals by EPA Method 200.8***

***Total Metals by EPA Method 6020***

***Total Organic Carbon by EPA Method 9060***

This report consists of the following:

- Case Narrative
- Analytical Results
- Applicable Quality Control Summary Reports
- Chain of Custody

All analyses were performed consistent with the Quality Assurance program of Fremont Analytical, Inc. Please contact the laboratory if you should have any questions about the results.

Thank you for using Fremont Analytical.

Sincerely,

A handwritten signature in black ink, appearing to read "Mike Ridgeway", written over a light blue horizontal line.

Mike Ridgeway  
President



---

**CLIENT:** Floyd | Snider  
**Project:** COT-MMB  
**Lab Order:** 1502167

---

**Work Order Sample Summary**

Lab Sample ID	Client Sample ID	Date/Time Collected	Date/Time Received
1502167-001	PC-1-021415	02/14/2015 12:20 PM	02/16/2015 7:45 AM
1502167-002	MMB-DUP	02/14/2015 12:30 PM	02/16/2015 7:45 AM
1502167-003	PC-2-021415	02/14/2015 12:40 PM	02/16/2015 7:45 AM
1502167-004	MMB-6-D1	02/14/2015 12:55 PM	02/16/2015 7:45 AM
1502167-005	MMB-6-V1	02/14/2015 1:30 PM	02/16/2015 7:45 AM
1502167-006	MMB-6-D7	02/14/2015 2:15 PM	02/16/2015 7:45 AM
1502167-007	Rinsate	02/14/2015 2:50 PM	02/16/2015 7:45 AM

---

**CLIENT:** Floyd | Snider  
**Project:** COT-MMB

---

**I. SAMPLE RECEIPT:**

Samples receipt information is recorded on the attached Sample Receipt Checklist.

**II. GENERAL REPORTING COMMENTS:**

Results are reported on a wet weight basis unless dry-weight correction is denoted in the units field on the analytical report ("mg/kg-dry" or "ug/kg-dry").

Matrix Spike (MS) and MS Duplicate (MSD) samples are tested from an analytical batch of "like" matrix to check for possible matrix effect. The MS and MSD will provide site specific matrix data only for those samples which are spiked by the laboratory. The sample chosen for spike purposes may or may not have been a sample submitted in this sample delivery group. The validity of the analytical procedures for which data is reported in this analytical report is determined by the Laboratory Control Sample (LCS) and the Method Blank (MB). The LCS and the MB are processed with the samples and the MS/MSD to ensure method criteria are achieved throughout the entire analytical process.

**III. ANALYSES AND EXCEPTIONS:**

Exceptions associated with this report will be footnoted in the analytical results page(s) or the quality control summary page(s) and/or noted below.



## Analytical Report

WO#: 1502167

Date Reported: 2/17/2015

Client: Floyd | Snider

Collection Date: 2/14/2015 12:20:00 PM

Project: COT-MMB

Lab ID: 1502167-001

Matrix: Sediment

Client Sample ID: PC-1-021415

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
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**Mercury by EPA Method 7471**

Batch ID: 10058

Analyst: MW

Mercury	ND	0.248		mg/Kg-dry	1	2/16/2015 5:28:41 PM
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**Total Metals by EPA Method 6020**

Batch ID: 10055

Analyst: TN

Copper	9.28	0.165		mg/Kg-dry	1	2/16/2015 4:58:04 PM
Lead	0.962	0.165		mg/Kg-dry	1	2/16/2015 4:58:04 PM
Zinc	17.2	0.412		mg/Kg-dry	1	2/16/2015 4:58:04 PM

**Sample Moisture (Percent Moisture)**

Batch ID: R20731

Analyst: CG

Percent Moisture	3.01			wt%	1	2/16/2015 1:02:36 PM
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**Total Organic Carbon by EPA Method 9060**

Batch ID: 10067

Analyst: KT

Total Organic Carbon	1.05	0.0500		%-dry	1	2/17/2015 1:06:00 PM
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**Qualifiers:** B Analyte detected in the associated Method Blank  
E Value above quantitation range  
J Analyte detected below quantitation limits  
RL Reporting Limit

D Dilution was required  
H Holding times for preparation or analysis exceeded  
ND Not detected at the Reporting Limit  
S Spike recovery outside accepted recovery limits



## Analytical Report

WO#: 1502167

Date Reported: 2/17/2015

Client: Floyd | Snider

Collection Date: 2/14/2015 12:30:00 PM

Project: COT-MMB

Lab ID: 1502167-002

Matrix: Sediment

Client Sample ID: MMB-DUP

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
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### Mercury by EPA Method 7471

Batch ID: 10058 Analyst: MW

Mercury	ND	0.249		mg/Kg-dry	1	2/16/2015 5:35:10 PM
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### Total Metals by EPA Method 6020

Batch ID: 10055 Analyst: TN

Copper	7.00	0.156		mg/Kg-dry	1	2/16/2015 5:26:20 PM
Lead	0.832	0.156		mg/Kg-dry	1	2/16/2015 5:26:20 PM
Zinc	14.9	0.389		mg/Kg-dry	1	2/16/2015 5:26:20 PM

### Sample Moisture (Percent Moisture)

Batch ID: R20731 Analyst: CG

Percent Moisture	3.45			wt%	1	2/16/2015 1:02:36 PM
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### Total Organic Carbon by EPA Method 9060

Batch ID: 10067 Analyst: KT

Total Organic Carbon	1.51	0.0500		%-dry	1	2/17/2015 1:26:00 PM
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**Qualifiers:** B Analyte detected in the associated Method Blank  
E Value above quantitation range  
J Analyte detected below quantitation limits  
RL Reporting Limit

D Dilution was required  
H Holding times for preparation or analysis exceeded  
ND Not detected at the Reporting Limit  
S Spike recovery outside accepted recovery limits



## Analytical Report

WO#: 1502167

Date Reported: 2/17/2015

Client: Floyd | Snider

Collection Date: 2/14/2015 12:40:00 PM

Project: COT-MMB

Lab ID: 1502167-003

Matrix: Sediment

Client Sample ID: PC-2-021415

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
<b><u>Mercury by EPA Method 7471</u></b>				Batch ID: 10058		Analyst: MW
Mercury	ND	0.256		mg/Kg-dry	1	2/16/2015 5:36:46 PM
<b><u>Total Metals by EPA Method 6020</u></b>				Batch ID: 10055		Analyst: TN
Copper	10.7	0.163		mg/Kg-dry	1	2/16/2015 5:29:52 PM
Lead	1.31	0.163		mg/Kg-dry	1	2/16/2015 5:29:52 PM
Zinc	22.5	0.407		mg/Kg-dry	1	2/16/2015 5:29:52 PM
<b><u>Sample Moisture (Percent Moisture)</u></b>				Batch ID: R20731		Analyst: CG
Percent Moisture	4.11			wt%	1	2/16/2015 1:02:36 PM
<b><u>Total Organic Carbon by EPA Method 9060</u></b>				Batch ID: 10067		Analyst: KT
Total Organic Carbon	1.26	0.0500		%-dry	1	2/17/2015 1:44:00 PM

**Qualifiers:** B Analyte detected in the associated Method Blank  
E Value above quantitation range  
J Analyte detected below quantitation limits  
RL Reporting Limit

D Dilution was required  
H Holding times for preparation or analysis exceeded  
ND Not detected at the Reporting Limit  
S Spike recovery outside accepted recovery limits





## Analytical Report

WO#: 1502167

Date Reported: 2/17/2015

Client: Floyd | Snider

Collection Date: 2/14/2015 12:55:00 PM

Project: COT-MMB

Lab ID: 1502167-004

Matrix: Sediment

Client Sample ID: MMB-6-D1

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
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### Mercury by EPA Method 7471

Batch ID: 10058 Analyst: MW

Mercury	ND	0.405		mg/Kg-dry	1	2/16/2015 5:38:21 PM
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### Total Metals by EPA Method 6020

Batch ID: 10055 Analyst: TN

Copper	84.1	0.288		mg/Kg-dry	1	2/16/2015 5:33:24 PM
Lead	81.3	0.288		mg/Kg-dry	1	2/16/2015 5:33:24 PM
Zinc	138	0.721		mg/Kg-dry	1	2/16/2015 5:33:24 PM

### Sample Moisture (Percent Moisture)

Batch ID: R20731 Analyst: CG

Percent Moisture	45.0			wt%	1	2/16/2015 1:02:36 PM
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### Total Organic Carbon by EPA Method 9060

Batch ID: 10067 Analyst: KT

Total Organic Carbon	1.94	0.0500		%-dry	1	2/17/2015 3:28:19 PM
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**Qualifiers:** B Analyte detected in the associated Method Blank  
E Value above quantitation range  
J Analyte detected below quantitation limits  
RL Reporting Limit

D Dilution was required  
H Holding times for preparation or analysis exceeded  
ND Not detected at the Reporting Limit  
S Spike recovery outside accepted recovery limits



## Analytical Report

WO#: 1502167

Date Reported: 2/17/2015

Client: Floyd | Snider

Collection Date: 2/14/2015 1:30:00 PM

Project: COT-MMB

Lab ID: 1502167-005

Matrix: Sediment

Client Sample ID: MMB-6-V1

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
<b><u>Mercury by EPA Method 7471</u></b>				Batch ID: 10058		Analyst: MW
Mercury	ND	0.383		mg/Kg-dry	1	2/16/2015 5:39:57 PM
<b><u>Total Metals by EPA Method 6020</u></b>				Batch ID: 10055		Analyst: TN
Copper	70.1	0.258		mg/Kg-dry	1	2/16/2015 5:36:56 PM
Lead	73.1	0.258		mg/Kg-dry	1	2/16/2015 5:36:56 PM
Zinc	138	0.645		mg/Kg-dry	1	2/16/2015 5:36:56 PM
<b><u>Sample Moisture (Percent Moisture)</u></b>				Batch ID: R20731		Analyst: CG
Percent Moisture	41.7			wt%	1	2/16/2015 1:02:36 PM
<b><u>Total Organic Carbon by EPA Method 9060</u></b>				Batch ID: 10067		Analyst: KT
Total Organic Carbon	1.78	0.0500		%-dry	1	2/17/2015 3:43:19 PM

**Qualifiers:** B Analyte detected in the associated Method Blank  
E Value above quantitation range  
J Analyte detected below quantitation limits  
RL Reporting Limit

D Dilution was required  
H Holding times for preparation or analysis exceeded  
ND Not detected at the Reporting Limit  
S Spike recovery outside accepted recovery limits



## Analytical Report

WO#: 1502167

Date Reported: 2/17/2015

Client: Floyd | Snider

Collection Date: 2/14/2015 2:15:00 PM

Project: COT-MMB

Lab ID: 1502167-006

Matrix: Sediment

Client Sample ID: MMB-6-D7

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
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### Mercury by EPA Method 7471

Batch ID: 10058 Analyst: MW

Mercury	ND	0.487		mg/Kg-dry	1	2/16/2015 5:44:49 PM
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### Total Metals by EPA Method 6020

Batch ID: 10055 Analyst: TN

Copper	83.7	0.314		mg/Kg-dry	1	2/16/2015 5:40:27 PM
Lead	109	0.314		mg/Kg-dry	1	2/16/2015 5:40:27 PM
Zinc	127	0.786		mg/Kg-dry	1	2/16/2015 5:40:27 PM

### Sample Moisture (Percent Moisture)

Batch ID: R20731 Analyst: CG

Percent Moisture	48.7			wt%	1	2/16/2015 1:02:36 PM
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### Total Organic Carbon by EPA Method 9060

Batch ID: 10067 Analyst: KT

Total Organic Carbon	2.18	0.0500		%-dry	1	2/17/2015 3:58:19 PM
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**Qualifiers:** B Analyte detected in the associated Method Blank  
E Value above quantitation range  
J Analyte detected below quantitation limits  
RL Reporting Limit

D Dilution was required  
H Holding times for preparation or analysis exceeded  
ND Not detected at the Reporting Limit  
S Spike recovery outside accepted recovery limits



## Analytical Report

WO#: 1502167

Date Reported: 2/17/2015

Client: Floyd | Snider

Collection Date: 2/14/2015 2:50:00 PM

Project: COT-MMB

Lab ID: 1502167-007

Matrix: Water

Client Sample ID: Rinsate

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
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**Mercury by EPA Method 245.1**

Batch ID: 10064

Analyst: MW

Mercury	ND	0.100		µg/L	1	2/17/2015 3:41:49 PM
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**Total Metals by EPA Method 200.8**

Batch ID: 10057

Analyst: TN

Copper	0.918	0.500		µg/L	1	2/16/2015 5:54:35 PM
Lead	ND	1.00		µg/L	1	2/16/2015 5:54:35 PM
Zinc	ND	1.50		µg/L	1	2/16/2015 5:54:35 PM

**Qualifiers:** B Analyte detected in the associated Method Blank  
E Value above quantitation range  
J Analyte detected below quantitation limits  
RL Reporting Limit

D Dilution was required  
H Holding times for preparation or analysis exceeded  
ND Not detected at the Reporting Limit  
S Spike recovery outside accepted recovery limits



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(b) (4)







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(b)(4)

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(b)(4)





Date: 2/17/2015

Work Order: 1502167  
CLIENT: Floyd | Snider  
Project: COT-MMB

## QC SUMMARY REPORT

### Total Organic Carbon by EPA Method 9060

Sample ID: <b>MB-10067</b>	SampType: <b>MBLK</b>	Units: <b>%-dry</b>		Prep Date: <b>2/17/2015</b>	RunNo: <b>20760</b>
Client ID: <b>MBLKS</b>	Batch ID: <b>10067</b>			Analysis Date: <b>2/17/2015</b>	SeqNo: <b>394361</b>
Analyte	Result	RL	SPK value	SPK Ref Val	%REC LowLimit HighLimit RPD Ref Val %RPD RPDLimit Qual

Total Organic Carbon ND 0.0500

Sample ID: <b>LCS-10067</b>	SampType: <b>LCS</b>	Units: <b>%-dry</b>		Prep Date: <b>2/17/2015</b>	RunNo: <b>20760</b>
Client ID: <b>LCSS</b>	Batch ID: <b>10067</b>			Analysis Date: <b>2/17/2015</b>	SeqNo: <b>394362</b>
Analyte	Result	RL	SPK value	SPK Ref Val	%REC LowLimit HighLimit RPD Ref Val %RPD RPDLimit Qual

Total Organic Carbon 0.685 0.0500 0.6510 0 105 41.1 157

Sample ID: <b>1502169-004ADUP</b>	SampType: <b>DUP</b>	Units: <b>%-dry</b>		Prep Date: <b>2/17/2015</b>	RunNo: <b>20760</b>
Client ID: <b>BATCH</b>	Batch ID: <b>10067</b>			Analysis Date: <b>2/17/2015</b>	SeqNo: <b>394368</b>
Analyte	Result	RL	SPK value	SPK Ref Val	%REC LowLimit HighLimit RPD Ref Val %RPD RPDLimit Qual

Total Organic Carbon 0.637 0.0500 0.6351 0.346 30

Sample ID: <b>1502169-004AMS</b>	SampType: <b>MS</b>	Units: <b>%-dry</b>		Prep Date: <b>2/17/2015</b>	RunNo: <b>20760</b>
Client ID: <b>BATCH</b>	Batch ID: <b>10067</b>			Analysis Date: <b>2/17/2015</b>	SeqNo: <b>394369</b>
Analyte	Result	RL	SPK value	SPK Ref Val	%REC LowLimit HighLimit RPD Ref Val %RPD RPDLimit Qual

Total Organic Carbon 1.60 0.0500 1.000 0.6351 96.3 50.2 118

Sample ID: <b>1502169-004AMSD</b>	SampType: <b>MSD</b>	Units: <b>%-dry</b>		Prep Date: <b>2/17/2015</b>	RunNo: <b>20760</b>
Client ID: <b>BATCH</b>	Batch ID: <b>10067</b>			Analysis Date: <b>2/17/2015</b>	SeqNo: <b>394370</b>
Analyte	Result	RL	SPK value	SPK Ref Val	%REC LowLimit HighLimit RPD Ref Val %RPD RPDLimit Qual

Total Organic Carbon 1.60 0.0500 1.000 0.6351 96.9 50.2 118 1.598 0.375 20

**Qualifiers:**

B	Analyte detected in the associated Method Blank	D	Dilution was required	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits	ND	Not detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Limit	S	Spike recovery outside accepted recovery limits



Date: 2/17/2015

Work Order: 1502167  
CLIENT: Floyd | Snider  
Project: COT-MMB

**QC SUMMARY REPORT**  
**Total Metals by EPA Method 200.8**

Sample ID: <b>MB-10057</b>	SampType: <b>MBLK</b>	Units: <b>µg/L</b>		Prep Date: <b>2/16/2015</b>	RunNo: <b>20736</b>
Client ID: <b>MBLKW</b>	Batch ID: <b>10057</b>	Analysis Date: <b>2/16/2015</b>		SeqNo: <b>393937</b>	
Analyte	Result	RL	SPK value	SPK Ref Val	%REC LowLimit HighLimit RPD Ref Val %RPD RPDLimit Qual

Copper	ND	0.500
Lead	ND	1.00
Zinc	ND	1.50

Sample ID: <b>LCS-10057</b>	SampType: <b>LCS</b>	Units: <b>µg/L</b>		Prep Date: <b>2/16/2015</b>	RunNo: <b>20736</b>
Client ID: <b>LCSW</b>	Batch ID: <b>10057</b>	Analysis Date: <b>2/16/2015</b>		SeqNo: <b>393938</b>	
Analyte	Result	RL	SPK value	SPK Ref Val	%REC LowLimit HighLimit RPD Ref Val %RPD RPDLimit Qual

Copper	106	0.500	100.0	0	106	85	115
Lead	49.9	1.00	50.00	0	99.8	85	115
Zinc	110	1.50	100.0	0	110	85	115

Sample ID: <b>1502167-007ADUP</b>	SampType: <b>DUP</b>	Units: <b>µg/L</b>		Prep Date: <b>2/16/2015</b>	RunNo: <b>20736</b>
Client ID: <b>Rinsate</b>	Batch ID: <b>10057</b>	Analysis Date: <b>2/16/2015</b>		SeqNo: <b>393942</b>	
Analyte	Result	RL	SPK value	SPK Ref Val	%REC LowLimit HighLimit RPD Ref Val %RPD RPDLimit Qual

Copper	0.794	0.500					0.9175	14.4	30
Lead	ND	1.00					0		30
Zinc	ND	1.50					0		30

Sample ID: <b>1502167-007AMS</b>	SampType: <b>MS</b>	Units: <b>µg/L</b>		Prep Date: <b>2/16/2015</b>	RunNo: <b>20736</b>
Client ID: <b>Rinsate</b>	Batch ID: <b>10057</b>	Analysis Date: <b>2/16/2015</b>		SeqNo: <b>393943</b>	
Analyte	Result	RL	SPK value	SPK Ref Val	%REC LowLimit HighLimit RPD Ref Val %RPD RPDLimit Qual

Copper	526	0.500	500.0	0.9175	105	70	130
Lead	241	1.00	250.0	0.2785	96.5	70	130
Zinc	516	1.50	500.0	0	103	70	130

**Qualifiers:**

B	Analyte detected in the associated Method Blank	D	Dilution was required	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits	ND	Not detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Limit	S	Spike recovery outside accepted recovery limits



**Work Order:** 1502167  
**CLIENT:** Floyd | Snider  
**Project:** COT-MMB

## QC SUMMARY REPORT

### Total Metals by EPA Method 200.8

Sample ID: <b>1502167-007AMS</b>		SampType: <b>MS</b>			Units: <b>µg/L</b>		Prep Date: <b>2/16/2015</b>			RunNo: <b>20736</b>		
Client ID: <b>Rinsate</b>		Batch ID: <b>10057</b>			Analysis Date: <b>2/16/2015</b>					SeqNo: <b>393943</b>		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual	

Sample ID: <b>1502167-007AMSD</b>	SampType: <b>MSD</b>	Units: <b>µg/L</b>				Prep Date: <b>2/16/2015</b>			RunNo: <b>20736</b>		
Client ID: <b>Rinsate</b>	Batch ID: <b>10057</b>					Analysis Date: <b>2/16/2015</b>			SeqNo: <b>393944</b>		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Copper	519	0.500	500.0	0.9175	104	70	130	526.3	1.44	30	
Lead	238	1.00	250.0	0.2785	95.2	70	130	241.4	1.33	30	
Zinc	534	1.50	500.0	0	107	70	130	516.2	3.40	30	

<b>Qualifiers:</b>	B	Analyte detected in the associated Method Blank	D	Dilution was required	E	Value above quantitation range
	H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits	ND	Not detected at the Reporting Limit
	R	RPD outside accepted recovery limits	RL	Reporting Limit	S	Spike recovery outside accepted recovery limits



Date: 2/17/2015

Work Order: 1502167  
CLIENT: Floyd | Snider  
Project: COT-MMB

## QC SUMMARY REPORT

### Mercury by EPA Method 245.1

Sample ID: <b>MB-10064</b>	SampType: <b>MBLK</b>	Units: <b>µg/L</b>		Prep Date: <b>2/17/2015</b>	RunNo: <b>20761</b>
Client ID: <b>MBLKW</b>	Batch ID: <b>10064</b>	Analysis Date: <b>2/17/2015</b>		SeqNo: <b>394407</b>	
Analyte	Result	RL	SPK value	SPK Ref Val	%REC LowLimit HighLimit RPD Ref Val %RPD RPDLimit Qual
Mercury	ND	0.100			

Sample ID: <b>LCS-10064</b>	SampType: <b>LCS</b>	Units: <b>µg/L</b>		Prep Date: <b>2/17/2015</b>	RunNo: <b>20761</b>
Client ID: <b>LCSW</b>	Batch ID: <b>10064</b>	Analysis Date: <b>2/17/2015</b>		SeqNo: <b>394408</b>	
Analyte	Result	RL	SPK value	SPK Ref Val	%REC LowLimit HighLimit RPD Ref Val %RPD RPDLimit Qual
Mercury	2.35	0.100	2.500	0	94.0 85 115

Sample ID: <b>1502167-007ADUP</b>	SampType: <b>DUP</b>	Units: <b>µg/L</b>		Prep Date: <b>2/17/2015</b>	RunNo: <b>20761</b>
Client ID: <b>Rinsate</b>	Batch ID: <b>10064</b>	Analysis Date: <b>2/17/2015</b>		SeqNo: <b>394410</b>	
Analyte	Result	RL	SPK value	SPK Ref Val	%REC LowLimit HighLimit RPD Ref Val %RPD RPDLimit Qual
Mercury	ND	0.100			0 20

Sample ID: <b>1502167-007AMS</b>	SampType: <b>MS</b>	Units: <b>µg/L</b>		Prep Date: <b>2/17/2015</b>	RunNo: <b>20761</b>
Client ID: <b>Rinsate</b>	Batch ID: <b>10064</b>	Analysis Date: <b>2/17/2015</b>		SeqNo: <b>394411</b>	
Analyte	Result	RL	SPK value	SPK Ref Val	%REC LowLimit HighLimit RPD Ref Val %RPD RPDLimit Qual
Mercury	2.27	0.100	2.500	0	90.8 80 120

Sample ID: <b>1502167-007AMSD</b>	SampType: <b>MSD</b>	Units: <b>µg/L</b>		Prep Date: <b>2/17/2015</b>	RunNo: <b>20761</b>
Client ID: <b>Rinsate</b>	Batch ID: <b>10064</b>	Analysis Date: <b>2/17/2015</b>		SeqNo: <b>394412</b>	
Analyte	Result	RL	SPK value	SPK Ref Val	%REC LowLimit HighLimit RPD Ref Val %RPD RPDLimit Qual
Mercury	2.28	0.100	2.500	0	91.2 80 120 2.270 0.440 20

**Qualifiers:**

B Analyte detected in the associated Method Blank  
H Holding times for preparation or analysis exceeded  
R RPD outside accepted recovery limits

D Dilution was required  
J Analyte detected below quantitation limits  
RL Reporting Limit

E Value above quantitation range  
ND Not detected at the Reporting Limit  
S Spike recovery outside accepted recovery limits



Date: 2/17/2015

Work Order: 1502167  
CLIENT: Floyd | Snider  
Project: COT-MMB

**QC SUMMARY REPORT**  
**Total Metals by EPA Method 6020**

Sample ID: <b>MB-10055</b>	SampType: <b>MBLK</b>	Units: <b>mg/Kg</b>		Prep Date: <b>2/16/2015</b>	RunNo: <b>20735</b>
Client ID: <b>MBLKS</b>	Batch ID: <b>10055</b>	Analysis Date: <b>2/16/2015</b>		SeqNo: <b>393903</b>	
Analyte	Result	RL	SPK value	SPK Ref Val	%REC LowLimit HighLimit RPD Ref Val %RPD RPDLimit Qual
Copper	ND	0.200			
Lead	ND	0.200			
Zinc	ND	0.500			

Sample ID: <b>LCS-10055</b>	SampType: <b>LCS</b>	Units: <b>mg/Kg</b>		Prep Date: <b>2/16/2015</b>	RunNo: <b>20735</b>
Client ID: <b>LCSS</b>	Batch ID: <b>10055</b>	Analysis Date: <b>2/16/2015</b>		SeqNo: <b>393904</b>	
Analyte	Result	RL	SPK value	SPK Ref Val	%REC LowLimit HighLimit RPD Ref Val %RPD RPDLimit Qual
Copper	275	0.200	258.0	0	106 76 128.3
Lead	134	0.200	138.0	0	97.1 73.2 127.5
Zinc	197	0.500	173.0	0	114 69.4 131.2

Sample ID: <b>1502167-001ADUP</b>	SampType: <b>DUP</b>	Units: <b>mg/Kg-dry</b>		Prep Date: <b>2/16/2015</b>	RunNo: <b>20735</b>
Client ID: <b>PC-1-021415</b>	Batch ID: <b>10055</b>	Analysis Date: <b>2/16/2015</b>		SeqNo: <b>393906</b>	
Analyte	Result	RL	SPK value	SPK Ref Val	%REC LowLimit HighLimit RPD Ref Val %RPD RPDLimit Qual
Copper	9.91	0.165			9.284 6.51 20
Lead	0.868	0.165			0.9620 10.3 20
Zinc	16.8	0.412			17.21 2.43 20

Sample ID: <b>1502167-001AMS</b>	SampType: <b>MS</b>	Units: <b>mg/Kg-dry</b>		Prep Date: <b>2/16/2015</b>	RunNo: <b>20735</b>
Client ID: <b>PC-1-021415</b>	Batch ID: <b>10055</b>	Analysis Date: <b>2/16/2015</b>		SeqNo: <b>393908</b>	
Analyte	Result	RL	SPK value	SPK Ref Val	%REC LowLimit HighLimit RPD Ref Val %RPD RPDLimit Qual
Copper	52.6	0.165	41.24	9.284	105 75 125
Lead	19.8	0.165	20.62	0.9620	91.5 75 125
Zinc	63.8	0.412	41.24	17.21	113 75 125

**Qualifiers:**

B	Analyte detected in the associated Method Blank	D	Dilution was required	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits	ND	Not detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Limit	S	Spike recovery outside accepted recovery limits



Date: 2/17/2015

Work Order: 1502167  
CLIENT: Floyd | Snider  
Project: COT-MMB

## QC SUMMARY REPORT

### Total Metals by EPA Method 6020

Sample ID: <b>1502167-001AMS</b>		SampType: <b>MS</b>		Units: <b>mg/Kg-dry</b>		Prep Date: <b>2/16/2015</b>			RunNo: <b>20735</b>			
Client ID: <b>PC-1-021415</b>		Batch ID: <b>10055</b>					Analysis Date: <b>2/16/2015</b>			SeqNo: <b>393908</b>		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual	

Sample ID: <b>1502167-001AMSD</b>	SampType: <b>MSD</b>	Units: <b>mg/Kg-dry</b>				Prep Date: <b>2/16/2015</b>			RunNo: <b>20735</b>		
Client ID: <b>PC-1-021415</b>	Batch ID: <b>10055</b>	Analysis Date: <b>2/16/2015</b>							SeqNo: <b>393909</b>		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Copper	51.9	0.165	41.24	9.284	103	75	125	52.59	1.37	20	
Lead	19.3	0.165	20.62	0.9620	89.1	75	125	19.82	2.45	20	
Zinc	64.6	0.412	41.24	17.21	115	75	125	63.76	1.25	20	

**Qualifiers:**

B	Analyte detected in the associated Method Blank	D	Dilution was required	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits	ND	Not detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Limit	S	Spike recovery outside accepted recovery limits



Date: 2/17/2015

Work Order: 1502167  
CLIENT: Floyd | Snider  
Project: COT-MMB

## QC SUMMARY REPORT

### Mercury by EPA Method 7471

Sample ID: <b>MB-10058</b>	SampType: <b>MBLK</b>	Units: <b>mg/Kg</b>			Prep Date: <b>2/16/2015</b>			RunNo: <b>20737</b>			
Client ID: <b>MBLKS</b>	Batch ID: <b>10058</b>				Analysis Date: <b>2/16/2015</b>			SeqNo: <b>393961</b>			
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Mercury	ND	0.250									
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Sample ID: <b>LCS-10058</b>		SampType: <b>LCS</b>			Units: <b>mg/Kg</b>		Prep Date: <b>2/16/2015</b>			RunNo: <b>20737</b>		
Client ID: <b>LCSS</b>		Batch ID: <b>10058</b>			Analysis Date: <b>2/16/2015</b>					SeqNo: <b>393962</b>		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual	

Mercury	5.21	0.250	5.000	0	104	80	120				
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Sample ID: <b>1502167-001ADUP</b>	SampType: <b>DUP</b>	Units: <b>mg/Kg-dry</b>				Prep Date: <b>2/16/2015</b>			RunNo: <b>20737</b>		
Client ID: <b>PC-1-021415</b>	Batch ID: <b>10058</b>					Analysis Date: <b>2/16/2015</b>			SeqNo: <b>393964</b>		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Mercury	ND	0.243						0		20	
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Sample ID: <b>1502167-001AMS</b>		SampType: <b>MS</b>		Units: <b>mg/Kg-dry</b>		Prep Date: <b>2/16/2015</b>			RunNo: <b>20737</b>		
Client ID: <b>PC-1-021415</b>		Batch ID: <b>10058</b>					Analysis Date: <b>2/16/2015</b>			SeqNo: <b>393965</b>	
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Mercury	0.500	0.248	0.4957	0.003272	100	70	130				
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Sample ID: <b>1502167-001AMSD</b>		SampType: <b>MSD</b>		Units: <b>mg/Kg-dry</b>		Prep Date: <b>2/16/2015</b>			RunNo: <b>20737</b>			
Client ID: <b>PC-1-021415</b>		Batch ID: <b>10058</b>					Analysis Date: <b>2/16/2015</b>			SeqNo: <b>393966</b>		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual	

Mercury	0.510	0.248	0.4957	0.003272	102	70	130	0.4997	1.96	20	
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**Qualifiers:**

B	Analyte detected in the associated Method Blank	D	Dilution was required	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits	ND	Not detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Limit	S	Spike recovery outside accepted recovery limits



## Sample Log-In Check List

Client Name: **FS**  
 Logged by: **Kerra Ziegler**

Work Order Number: **1502167**  
 Date Received: **2/16/2015 7:45:00 AM**

### Chain of Custody

1. Is Chain of Custody complete? Yes ☒ No ☐ Not Present ☐  
 2. How was the sample delivered? Client

### Log In

3. Coolers are present? Yes ☒ No ☐ NA ☐  
 4. Shipping container/cooler in good condition? Yes ☒ No ☐  
 5. Custody seals intact on shipping container/cooler? Yes ☐ No ☐ Not Required ☒  
 6. Was an attempt made to cool the samples? Yes ☒ No ☐ NA ☐  
 7. Were all coolers received at a temperature of >0°C to 10.0°C? Yes ☒ No ☐ NA ☐  
 8. Sample(s) in proper container(s)? Yes ☒ No ☐  
 9. Sufficient sample volume for indicated test(s)? Yes ☒ No ☐  
 10. Are samples properly preserved? Yes ☒ No ☐  
 11. Was preservative added to bottles? Yes ☐ No ☒ NA ☐  
 12. Is the headspace in the VOA vials? Yes ☐ No ☐ NA ☒  
 13. Did all samples containers arrive in good condition(unbroken)? Yes ☒ No ☐  
 14. Does paperwork match bottle labels? Yes ☒ No ☐  
 15. Are matrices correctly identified on Chain of Custody? Yes ☒ No ☐  
 16. Is it clear what analyses were requested? Yes ☒ No ☐  
 17. Were all holding times able to be met? Yes ☒ No ☐

### Special Handling (if applicable)

18. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☒

Person Notified:  Date:   
 By Whom:  Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person  
 Regarding:   
 Client Instructions:

19. Additional remarks:

### Item Information

Item #	Temp °C	Condition
Cooler 1	2.0	Good
Cooler 2	2.2	Good
Sample 1	1.5	Good
Sample 2	1.6	Good

Fremont Analytical		Chain of Custody Record																			
3600 Fremont Ave N. Seattle, WA 98103		Tel: 206-352-3790 Fax: 206-352-7178																			
Client: <u>Floyd Snider</u>		Laboratory Project No (internal): <u>1502167</u>																			
Address: <u>601 Union St. Suite 600</u>		Page: <u>1</u> of <u>1</u>																			
City, State, Zip: <u>Seattle, WA 98101</u>		Project Name: <u>COT-mmb</u>																			
Tel: <u>206-292-2078</u>		Location: <u>Murray Morgan Bridge</u>																			
Reports To (PM): <u>Amanda McKay</u>		Collected by: <u>A. McKay</u>																			
Fax: _____		Email: <u>amanda.mckay@floyd-snider.com</u>																			
*Matrix Codes: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, WW = Waste Water																					
Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	VOC (EPA 8160)	SVOC (EPA 8160)	BTX	Gasoline Range Organics (GRO)	Hydrocarbon Intermediates (HCOI)	Distillate Range Organics (DRO)	SEMI VOL (EPA 8270)	PAH (EPA 8270 - SEM)	PCBs (EPA 8007)	Metals** (60330 / 200.4)	Total (T) / Dissolved (D)	Anions (IC)*	ESR (8011)	15 Day Size	TSS	100% Solids	Metals (Cu, Zn, Pb, Hg)	Comments/Depth
1 PC-1-021415	2/14/15	12:20	SD											X	X	X	X				
2 MMB-DVD		12:30												X	X	X	X				
3 PC-2-021415		12:40												X	X	X	X				
4 MMB-6-DI		12:55												X	X	X	X				
5 MMB-6-VI		13:30												X	X	X	X				
6 MMB-6-D7		14:15	↓											X	X	X	X				
7 Rinse	↓	14:50	W															X			
8																					
9																					
10																					
**Metals Analysis (Circle): MTCA-S, RCRA-B, Priority Pollutants, TAL, Individual: Ag, Al, As, B, Ba, Be, Ca, Cd, Co, Cr, <u>Cu</u> , Fe, <u>Hg</u> , K, Mg, Mn, Mo, Na, Ni, <u>Pb</u> , Sb, Se, Sr, Sn, Ti, T, U, V, <u>Zn</u>																					
***Anions (Circle): Nitrate, Nitrite, Chloride, Sulfate, Bromide, O-Phosphate, Fluoride, Nitrate+Nitrite				Special Remarks:																	
Sample Disposal: <input type="checkbox"/> Return to Client <input type="checkbox"/> Disposal by Lab (A fee may be assessed if samples are retained after 30 days.)				metals - Cu, Zn, Pb, Hg																	
Relinquished: <u>[Signature]</u> Date/Time: <u>2/14/15 15:35</u>				Received: <u>Breck for 2/16/15 7459</u>																	
Relinquished: _____ Date/Time: _____				Received: _____ Date/Time: _____																	
TAT -> SameDay* NextDay* 2 Day 3 Day STD				*Please coordinate with the lab in advance																	